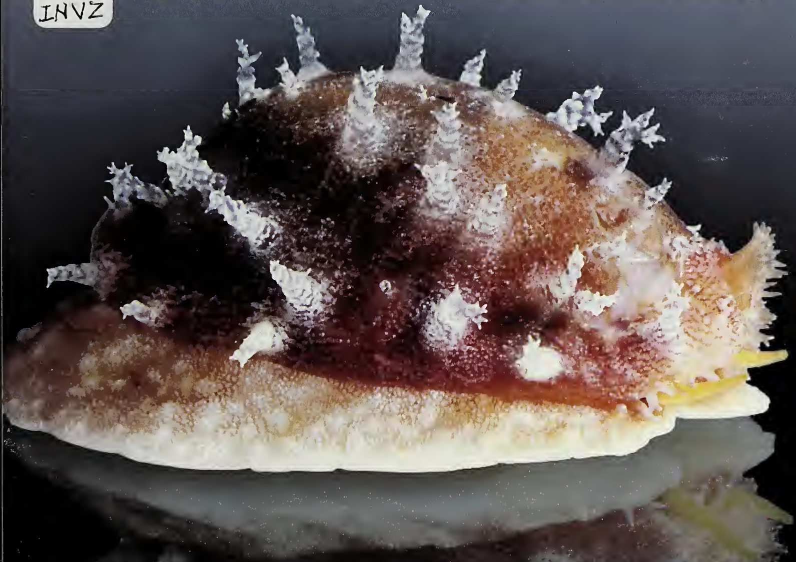
THE Festivus

Vol. 48(1) February 2016



side:

he *Talostolida pellucens* Complex

New Subspecies of *Oliva* from Java

olving the *Haliotis multiperforata* Puzzle

utant Sinistral *Polygyridae*

Quarterly Publication of the San Diego Shell Club

ISSN 0738-9388

THE FESTIVUS

A publication of the San Diego Shell Club

Volume: 48 February 2016 ISSUE 1

MEMBERSHIP AND SUBSCRIPTION

Annual dues are payable to the San Diego Shell Club Membership: Domestic/Foreign $20 (receive e-mail copy of *The Festivus*); Domestic $35 (receive *The Festivus* by mail), Foreign/outside the continental United States $55 (receive a copy of *The Festivus* by mail). Single copies of each regular issue are $10.00 plus postage.

Address all correspondence to:
The San Diego Shell Club, Inc.
P.O. Box 230988, Encinitas, CA 92023

REGULAR CLUB MEETINGS

Club meetings are held on the third Thursday or Saturday of the month, except April, September and December, at either 7:30 p.m. in Room 104, Casa del Prado, Balboa Park, San Diego, or at 12:00 noon at Holiday Inn Express, 751 Raintree Dr., Carlsbad, conference room or as noticed.

FACEBOOK

https://www.facebook.com/groups/620724271299410/

WEBSITE

http://www.sandiegoshellclub.com

Submit comments or suggestions regarding our website to our Webmaster David Waller at dwaller@dbwipmg.com.

FRONT COVER:

Live animal photo of *Talostolida pellucens sumeihoae* Daughenbaugh & Beals, 2013. Photo courtesy of Dr. Henry Chaney. (Cover artistic credit: Martin Schuler)

MISSION STATEMENT

The San Diego Shell Club was founded in 1961 as a non-profit organization for educational and scientific purposes. More particularly to enjoy, study and promote the conservation of Mollusca and associated marine life through lectures, club meetings and field trips. Our membership is diverse and includes beginning collectors, scientists, divers, underwater photographers and dealers.

THE FESTIVUS is the official quarterly publication of the San Diego Shell Club, Inc. and is issued as part of membership dues in February, May, August and November. *The Festivus* publishes articles that are peer reviewed by our volunteer Scientific Peer Review Board, as well as articles of general interest to malacologists, conchologists, and shell collectors of every level. Members of the Peer Review Board are selected to review individual articles based upon their chosen field of expertise and preference. Available by request or on our website are:

- Guidelines for Authors
- Guidelines for the Description of New Taxa

Submit articles to Editor, David Berschauer, at shellcollection@hotmail.com

All correspondence pertaining to articles, including all submissions and artwork should be addressed to the Editorial Board.

UPCOMING CLUB EVENTS:

April Auction: 4/15/16
West Coast Shell Show: 5/21-22/16
San Diego Co. Fair: 6/5 - 7/4/16
Bizarre Bazaar: 7/16/16
Balboa Park Show: 8/20/16
September Party: TBD
November Auction: 11/19/16

Publication date: February 1, 2016

San Diego Shell Club

Membership Renewal Form

Annual Membership Fees (Please select one):

☐ Domestic/Outside the U.S. Electronic Version $20

☐ Domestic Hard Copy Version $35

☐ Outside the U.S. Hard Copy Version $55

Individual Member Name ______________________________
Address ______________________________
City ____________ State ____ Zip Code ________ Country ________
Phone Number (   ) __________ E-Mail ____________________
Main Interests ______________________________

Dear Club member,

It is THAT time of year again. Our Treasurer has looked at his "naughty and nice" lists to determine who has paid their 2016 annual dues and who has not. Sadly you are one of the few who has not paid your 2016 Club dues. Please note that your reasonable dues help keep our little non-profit organization afloat, paying for such things as facility rentals, insurance, and printing and postage to send our quarterly journal to you and the other members. Annual dues renewal notices were mailed out in November. We have printed 140 copies of the current issue of *The Festivus* based upon the good faith belief that our membership is remaining at our current level, and that you intend to renew. Should you not pay your 2016 dues this <u>will be your last issue</u> and you will be removed from the active member Roster in March. We assume that your non-payment of dues is merely an oversight and that you wish to remain a member of the San Diego Shell Club.

<u>Please print and remit this form with membership check to:</u>
Bill Schramm, Treasurer
The San Diego Shell Club
P.O. Box 230988
Encinitas, CA 92023

San Diego Shell Club

2015 San Diego Shell Club Membership List

USA Individual Members

Abela, Bob, 4066 Brant Street Unit 1, San Diego, CA 92103
(619) 709-7790 bob.abela@gmail.com
Akin, Priscilla, 5173 Teton Lane, Ventura, CA 93003
(805) 234-7188 pakin@twc.com
Anderson, Don, 47-132 Nukupu Place, Kaneohe, HI 96744
(808) 239-4614 ymcadoc@mac.com
Baer, Dixie, 5454 Rear Country Road 30, Mount Gilead, OH 43338
No phone number dixiestanley@yahoo.com
Banwart, Mary, 2224 Navarro Drive, Claremont, CA 91711
(909) 624-5297 mb_fineart@hotmail.com
Barwick, Kelvin, 16391 Del Oro Circle, Huntington Beach, CA 92649
No phone number rictaxis@gmail.com
Beals, Marty, c/o Tideline, 640 S. Isis Avenue,Inglewood, CA 90301
(310) 641-9106 marty@tidelineusa.com
Bedell, Harry, 23852 Pacific Coast Highway #178, Malibu, CA 90265
(714) 968-5662 malibuone@aol.com
Berschauer, David, 25461 Barents St., Laguna Hills, CA 92653
(949) 581-9979 shellcollection@hotmail.com
Bertsch, Hans, 192 Imperial Beach Blvd, Unit A, Imperial Beach, CA 91932
(619) 423-8900 hansmarvida@sbcglobal.net
Bieler, Rüdiger, Field Museum of Natural History, Dept. of Zoology
1400 S. Lake Shore Drive, Chicago, IL 60605-2496
(312) 665-7720 Rbieler@fieldmuseum.org
Bogen, George, 321 N. Larchmont Blvd., Los Angeles, CA 90004
(323) 465-3116 rohbogen@att.net
Brewster, Brian, 4142 Adams Ave. #316, San Diego, CA 92116
(619) 210-3910 he_sits@cox.net
Bridges, Randy, 11837N. 22nd Place, Phoenix, AZ 85028-1005
No phone number, rbridges@rbridges.com
Brown, Chris, 4575 N Ave. del Cazador, Tucson, AZ 85718
(520) 229-3011 flashcove@msn.com
Brunken, Jeffrey, 108 14th Street, Delano, MN 55328
No phone number jsjjnbrunk@aol.com
Buck, Larry, 3649 Sage Canyon Drive, Encinitas, CA 92024
(760) 580-1726 larry@glbuckplumbing.com
Cargile, William P., 16500 Skyline Blvd., Woodside, CA 94062
(650) 851-8700 bill@cargile.com

Catarius, Larry & Debbie, 4173 Galt St., San Diego, CA 92117
(858) 270-4376 catarius@sbcglobal.net
Chaney, Henry W., 170 La Vista Grande, Santa Barbara, CA 93103
(805) 682-4711 hchaney@sbnature2.org
Clark, Roger, 3808 Pinehurst Dr., Eagle Mountain, UT 84005
No phone number, insignis_one@yahoo.com
Clement, John, 10934 Evening Creek Dr. East, Apt. 90, San Diego, CA 92128
(619) 851-2536 johnclement@cox.net
Coan, Eugene V., P.O. Box 420495, Summerland Key, FL 33042-0495
(650) 283-8959 gene.coan@sierraclub.org
Daughenbaugh, John, 203 N. Wilton Pl., Los Angeles, CA 90004-4025
(323) 465-3718 shoduffy@ca.rr.com
Dayton, Paul K., 608 Barbara Avenue, Solana Beach, CA 92075
(858) 755-7492 pdayton@ucsd.edu
Dees, Robert and Van, 399 Dorset, Cambria, CA 93428
(805) 927-2520 rdees37@yahoo.com
Des Chaine, Lewis, 3029 Silver Lake Road, St. Anthony, MN 55418
(612) 789-4070 lewisdeschaine@yahoo.com
Doi, Matthew, 16209 Taylor Court, Torrance, CA 90504-1901
(310) 324-3201 No e-mail address
Eernisse, Douglas J., Dept. of Biological Science, MH 282
California State University, Fullerton, CA 92834-6850
3413 Madonna Dr., Fullerton, CA 92835, (714) 871-5574
(657) 278-3749 deernisse@fullerton.edu
Emerson, William K., 10 E Avenue, Apt 18E, New York, NY 10075-118
(212) 879-7645 no email address
Enright, Wendy, 7474 Ashford Place, San Diego, CA 92111
(619) 379-1470 wenright@sandiego.gov
Everson, Gene, 500 Nottingham Parkway, Louisville, KY 40222-5026
(502) 429-5788 gene.everson@gmail.com
Farmer, Wes, 3591 Ruffin Road. #226, San Diego, CA 92123-2561
(858) 576-2143 wmfarmer13@adnc.com
Fenzan, William, 401 Sinclair Street, Norfolk, VA 23505
(757) 489-4736 hm., (757) 651-0943 bill@fenzan.com
Fletcher, Karin, 6074 Wynn Jones Rd. E, Port Orchard, WA 98366
(206) 459-0249 karin@milltech.com
Frank, William M., 1865 Debutante Drive, Jacksonville, FL 32246-8645
(904) 724-5326 strombus@bellsouth.net
Frein, Michael, 1231 Pineridge Drive, Cambria, CA 93428
(805) 464-8828 msfshells@gmail.com
Friedman, David M., 9400 Robinson Street, Overland Park, KS 66212
(816) 289-6521 dfriedman@kc.rr.com gerontius78@gmail.com
Gettleman, Alan, 2225 Tanglewood Lane, Merritt Island, FL 32953-4287
(321) 536-2896 Lychee@cfl.rr.com
Gilbertson, Lance, 1806 Dover Drive, Newport Beach, CA 92660-4419
(949) 631-3591 lngilbert@gmail.com
Goldammer, Marilyn & Jim, 10051 Sheba Way, San Diego, CA 92129
(858) 484-0575 mgoldammer1@att.net
Hale, Nancy, 2004 Rosecrans St., San Diego, CA 92106
(619) 222-0049 tomnan12@att.net

Hamilton, Ian, P.O. Box 6082, San Diego, CA 92166
(619) 376-5002 imh315@gmail.com
Herrmann, Richard & Ginny, 12545 Mustang Drive, Poway, CA 92064
(858) 679-7017 rbherrmann@cox.net
Hertz, Jules & Carole M., 3883 Mt. Blackburn Avenue, San Diego, CA 92111
(858) 277-6259 jhertz@san.rr.com
Inouye, Rick & Sheri, 1042B N. El Camino Real #266, Encinitas, CA 92024
No phone number winnerscircle4you@gmail.com
Ituarte, Daniel A., 10786 Riderwood Terrace, Unit B, Santee, CA 92071
(619) 758-2330 dituarte@cox.net
Jackson, Bobbi, 2258 Via Tesoro, Alpine, CA 91901
(619) 445-3796 rcjackson@earthlink.net
Jensen, Robert & Denise, 77-6496 Maile St., Kailua-Kona, HI 96740
(808) 989-0551 jensenr005@hawaii.rr.com iamunderdc@yahoo.com
Johnston, Bernard, 511 E. San Ysidro Blvd. #2006, San Ysidro, CA 92143
(619) 730-2352 shellsafeinc@gmail.com
Kalohi, Kathy & Joseph, 13901 Wilkie Avenue, Gardena, CA 90249-2816
(310) 719-1816 wreckdiver77@yahoo.com
Kanner, Paul, 10609 Ester Avenue, Los Angeles, CA 90064
(310) 863-2427 pkann@ca.rr.com
Kaufman, Murray, 9911 W. Pico Blvd., Ste. 780, Los Angeles, CA 90035
(310) 569-3899 murray300@aol.com
Keefe, Maureen, 254 Fremont Rd., Chester, NH 03036
(603) 887-1953 pinotgrigio@comcast.net
Kemp, Bruce, 9420 Carlton Oaks Dr. Unit D, Santee, CA 92071-2527
(619) 449-7610 bruce.kemp@navy.mil
Keppel, Erica, 514 Overhill Drive, Edgewater, MD 21037
(443) 905-6452 keppelerica@gmail.com
LaFollette, Patrick, 38700 Vista Dr., Cathedral City, CA 92234
(760) 770-3753 pat@lafollette.com
LaGrange, John, 533 N. Rios Ave., Solana Beach, CA 92075
(858) 255-7215 john.LaGrange@yahoo.com
Lanni, Lauren, 1245 San Elejo Road S, San Marcos, CA 92078-1073
(760) 815-7563 lauren@lanniinsurance.com
Lee, Julian K., 1630 N. Fuller Avenue, Apt. 1, Los Angeles, CA 90046
(323) 899-1081 jkl912@sbcglobal.net
Leighton, David, 315 Walnut Avenue #B, Carlsbad, CA 92008
(760) 637-5210 dlleighton71@yahoo.com
Lewis, Scot, 660 W. 3rd Street, Tustin, CA 92780
(714) 743-9932 slewis@lewcon.net
Lindahl, Lisa Dawn, 27041 Val Deane Way, Hemet, CA 92544
(951) 929-0990 barabronze@yahoo.com
Lum, David, 91-1134 Hoowalea St., Ewa Beach, HI 96706
(808) 306-2108 davidkwlum@hawaii.rr.com
Lutan, Robert, 8003 Presidio Court, Universal City, MO 63130
No phone number rlutan2008@yahoo.com
Luther, Doug & Mary, 1535 Ipukula Street, Honolulu, HI 96821-1419
(808) 377-5173 dluther@soest.hawaii.edu
Lyons, William G., 4227 Porpoise Drive SE, St. Petersburg, FL 33705-4328
No phone number w.lyons9@knology.net

Martin, Scott D., 2611 East Lake Ave. E. #102, Seattle, WA 98102
No phone number scottdouglasmartin@comcase.net
McBride, Danny, 18334 Collins St., Unit D, Tarzana, CA 91356
(818) 345-9238, ScuubaDude@aol.com
McClincy, Richard J., 2332 West Calle Ceja, Green Valley, AZ 85614-8067
(520) 625-5697 rjmcclincy@gmail.com
McLean, James H., c/o The Residence at South Windsor Farms
200 Deming Road, South Windsor, CT 06074
(860) 670-9510 jamesmclean58@icloud.com
Martinsen, Rob, 124 Oxnard Avenue, Oxnard, CA 93035
(818) 606-3855, martinsenshells@yahoo.com
Metz, George E., 121 Wild Horse Valley Drive, Novato, CA 94947-3615
(415) 892-4960 romageometz@comcast.net
Michalski, David, 43535 Kirkland Avenue #71, Lancaster, CA 93535
(805) 551-2752 dtaxmandm@gmail.com
Moore, Robert, 15539 Shefford Street, Hacienda Heights, CA 91745
(626) 336-0553 rmoorel3@roadrunner.com
Myers, John, 3761 Mt. Augustus Avenue, San Diego, CA 92111
(858) 279-9806 No e-mail address
Myers, Tammy L., 6237 Wailes Avenue, Norfolk, VA 23502
(757) 455-0789 henrylimpet@cox.net
Nash, Cole and Layla, 3383 Calle Cancuna, Calrsbad, CA 92009
(760) 978-5350, ms.monicanash@gmail.com
Negus, Richard H., 3401 Woodland Way, Carlsbad, CA 92008
(760) 434-9808 rnegus@roadrunner.com
Owen, Buzz & Miriam, P.O. Box 601, Gualala, California 95445-0601
(707) 884-3388, (415) 292-3459 buzabman@mcn.org
Pasqua, Robert A., 2326 Via Chalupa, San Clemente, CA 92673
(949) 842-2761 pasqua@cox.net
Petuch, Edward, Florida Atlantic University / Dept. Of Geosciences
777 Glades Road, Boca Raton, FL 33431
(561) 308-1492 epetuch@fau.edu
Phillips, Tony & Charles, 17 Vista del Canon, Aliso Viejo, CA 92656
(714) 397-0014 CUMACEA@yahoo.com
Pisor, Don & Jeanne, 10373 El Honcho Place, San Diego, CA 92124-1219
(858) 279-9342 dpisor@earthlink.net
Poremski, Andre, 51 S. Street NW, Washington, DC 20001
No phone number aporemski@gmail.com
Powell, Charles, 2932 Sunburst Dr., San Jose, CA 95111
(408) 363-0926 powell2@sbcglobal.net
Raffety, John Arjay, 13214 Fiji Way, Unit A, Marina del Rey, California 90292
(650) 903-9836 JArjayR@aol.com
Reitz, Chuck, 410 Orpheus Avenue, Leucadia, CA 92024
(760) 419-0424 crreitz@aol.com
Reeve, Barbara A., 1319 W. 29th Terrace, Independence, MO 64052
No phone number bajreeve@yahoo.com
Ritter, William J., 1005 Exchange Apt 13, Astoria, OR 97103-0900
(503) 325-7948 bulwinkl_29@msn.com
Roberts, Dale and Kimberly, 28402 Harvest View Lane, Trabuco Canyon, CA 92679
No phone number, No e-mail address

Sassi, Alexander P., 2617 College Avenue Apt. 12, Berkeley, CA 94704
(510) 206-8757 sfalexander@hotmail.com
Schoening, Robert C., P.O. Box 634, Coupeville, WA 98239-0634
(360) 678-3951 rschoening@aol.com
Schramm, William, 24151 Las Niranjas Drive, Laguna Niguel, CA 92677
(949) 495-6971 bschramm@ivc.edu
Schroeder, Linda, 5953 Artist Drive, Ferndale, WA 98248-8303
No phone number sheller60@hotmail.com
Schroeder, Walter, 8101 La Palma Drive, Huntington Beach, CA 92646
(714) 654-9682, No e-mail address
Schuler, Marty, 747 Ash Avenue, Chula Vista, CA 91910
(619) 420-8347 tagdot@cox.net
Sisco, Jeff, P.O. Box 2303, Carlsbad, CA 92018
(619) 578-1144, jsisco24@gmail.com
Smith, Evelyn J. & Don, 1710 Avenida del Mundo, Unit 1506, Coronado, CA 92118-3037
(619) 435-3073 smithdonevelyn@sbcglobal.net
Stilwill, Rex & Lauren Cole, 2054 Celadon Dr. NE, Grand Rapids, MI 49525,
(616) 240-3970 contactRBS5@gmail.com
Thomas, Diane, 992 Railborne Drive, Sparks, NV 89434
(775) 742-4555 funlab2@aol.com
Tucker, John, 731 Cantonment, Rantoul, IL 61866
No phone number johntucker@gtewc.com
Tuskes, Paul & Ann, 3808 Sioux Avenue, San Diego, CA 92117
(858) 274-5829 tuskes@aol.com
Valentich-Scott, Paul, Santa Barbara Museum of Natural History,
2559 Puesta del Sol, Santa Barbara, CA 93105,
(805) 682-4711 extn. 146 pvscott@sbnature2.org
Vawter, Doris, 3208 Bonita Mesa Road, Bonita, CA 91902
(619) 479-7687 vevawter@cox.net
Vollero, Silvana & Bob Petroski, 5613 Carnegie Street, San Diego, CA 92122
(858) 625-0756 svollero@san.rr.com
Waayers, Robyn, 5893 Mountain Meadow Road, Julian, CA 92036,
(760) 765-1624 rwaayers@gmail.com
Waller, David & Viviane, 505 North Willowspring Drive, Encinitas, CA 92024,
(858) 768-1864 dwaller@dbwipmg.com
Waters, Charlie, P.O. Box 189010 #227, Coronado, CA 92178
(619) 675-7092 waterwoodie@hotmail.com
Webster, Herb & Mella, 4403 Sierra Morena Avenue, Carlsbad, CA 92010
(760) 730-3648 mellamella@roadrunner.com herbiewebster@roadrunner.com
Wiedrick, Shawn G., 5351 Glenstone Drive, Huntington Beach, CA 92649
(714) 235-0633 shawnwiedrick@hotmail.com
Wilder, Chuck, ASG KU DOC, APO AE 09366, USA
fly2thec@yahoo.com
Willoughby, Dennis & Laura, 4438 Pescadero Ave., San Diego, CA 92107
(619) 224-2516 lpicante@cox.net
Woolsey, Jody, 3717 Bagley Avenue #206, Los Angeles, CA 90034-4148
(310) 839-1604 m.woolsey@att.net
Wright, Joel E., 7918 El Cajon Blvd., Unite N327, La Mesa, CA 91942-2515
(619) 947-5744 jwbayla@gmail.com

Foreign Members

Amigo, Jean-Pierre, 41 rue Pierre de Coubertin, 66000 Perpignan, France
No phone number, jeanpierreamigo@yahoo.fr
Boorman, Ken, 33 Courtyard Walk, Chatham, ON N7L553, Canada
No phone number lisas_lair_bookstore@kent.net
Crayssac, Vincent, 665 Rue des Hirondelles, Lot. Leoni, 98809 Mont Sud, New Caledonia
Home: 687-460-461, vitiga@canl.nc
Fernie, Charles, "Swansong" Crescent Palace, Lyford Cay, Nassau, Bahamas
No phone number charlesfernie@gmail.com
Gori, Sandro, Via Sernesi 7, 57123 Livorno, Italy
39-3383676433 sandrogori53@fastweb.it
Gra-tes, Chorchat, 83 Mu. 4 Ramintra 5, Yak 18, Ramintra Rd., Ta-raeng,
Bangken, Bangkok, Thailand 10220
chorchat@hotmail.com
Hiscock, Marin, 32 North Road, Brighton, Victoria 3186, Australia
martinhiscock@hotmail.com
Hollmann, Michael, Stockumer Heide 44, D-58454 Witten Germany
49-02302-944-255 michael.hollmann@rub.de
Jacques, Janine, 7 Rue Benoit Cassin, Terre de Haut, Guadeloupe
janine.jacques@wanadoo.fr
Kronenberg, Gijs C., Den Bult 98, NL-5616, Eindhoven,
The Netherlands, No phone number gijs.kronenberg@ziggo.nl
Lorenz, Felix, Fr-Ebert-Str. 12, 35418 Buseck, Germany
Home: 49-64086-4442, Felix.lorenz@t-online.de
Nguyen, Dr. Thach, 267 Thong Nhat Street, Nha Trang City, Vietnam
No phone number kurodashvietnam@yahoo.com
Pape, Robert, Fürsthof 14a, 24535 Neumünster, Germany
No phone number robipape@yahoo.de
Passamonti, Marco, Dipartimento di Scienze Biologiche Geologiche e Ambiental,
Università di Bologna via Selmi 3,40126 Bologna,Italy
marco.passamonti@unibo.it
Poppe, Guido, Conchology, Inc., Cebu Light Industrial Park, Basak,
Lapu-lapu City, Cebu 6015, Philippines
(+63) 32-495-9990 philippe@conchology.be
Pras, Stephane, 15 Rue Marbeau, 75116 Paris France
No phone number stephane.pras@noos.fr
Strano, Giorgio, c/o Museo Galileo, Piazza dei Giudici 1,
50122 Firenze, Italy g.strano@museogalileo.it
Tiago, Nelson, Rua da Boa Nova nº143, 4º dto, Valardes, 4405-535, V.N. Gaia, Portugal
Nelson_tyagoh@hotmail.com
Vulliet, Thierry, 78 Golden Bear Drive, Arundel, Queensland, Australia 4214
thierryvulliet@gmail.com

Institutional Members

AFC / Xenophora, c/o Alain Robin, 3 Rue de la Croix au Beau, F-78320
Le Mesnil St. Denis, France alrob38@orange.fr
American Museum of Natural History, Library / Serials - M Bolin
Central Park W. At 79th St., New York, NY 10024
Bouchet, Philippe, MNHN / Malacologie, 57 rue Cuvier 75231 Paris Cedex 05, France
No phone number, pbouchet@mnhn.fr
California Academy of Sciences, J.W. Mailliard Jr. Librarian,
Golden Gate Park, 55 Concourse Drive, San Francisco, CA 94118
No phone number, No e-mail address
Conchologists of America, c/o Anne Joffe, 1157 Periwinkle Way,
Sanibel Island, FL 33957
(239) 472-6991, sanibelseashells@aol.com
EBSCO Industries, P.O. Box 1953, Birmingham, AL 35201-1943
(205) 991-1234, No e-mail address
Hatsfield Marine Science Center / OSU, Marilyn Potts Guin Library
c/o Anja Bauer, 2030 S. Marine Science Drive, Newport, OR 97365-5296
No phone number abauer@harassowitz.de
Leal, Jose H., The Bailey-Matthews Shell Museum,
3075 Sanibel-Captiva Road, Sanibel, FL 33957
(239) 395-2233 jleal@shellmuseum.org
Mazatlan Library, PB3/00016747, P.O. Box 830470, Birmingham, AL 35283
Museum of New Zealand, Te Aka Matua Library, P.O. Box 467,
Wellington 6140, New Zealand
Natural History Museum of Los Angeles County,
c/o Lindsey Groves Malacology Section
900 Exposition Blvd., Los Angeles, CA 90007
(213) 763-3376 lgroves@nhm.org
Naturalis Bibliotheek, Postbus 9517, 2300 Ra Leiden, The Netherlands
Novapex, c/o Roland Houart, St. Jobsstraat, 8 B-3400 Landen (Ezemaal), Belgium
roland.houart@skynet.be
Royal Belgium Institute of Natural Sciences, Library - Bibliotheek, Vantierstraat 29,
B-1000, Brussels, Belgium
Santa Barbara Museum of Natural History, Department of
Invertebrate Zoology, 2559 Puesta del Sol, Santa Barbara, CA 93105-2936
(805) 682-4711 No e-mail address
Scripps Institute of Oceanography, SIO Library 0219
9500 Gilman Drive, La Jolla, CA 92093-0219
No phone number, No e-mail address
Smithsonian Institute Library, NHB 25 MRC 154, P.O. Box 37012
Washington, D.C. 20013
Universitaetsbibliothek, Johann Christan Senckenberg,
Zeitschriftenabteilung/DFG, Bockenheimer Landstr. 134-138
60325 Frankfurt am Main, Germany,
+41 61 306 15 56 g.dietz@libri.ch (Gisela Dietz)

The new San Diego Shell Club mugs are in. The price is $15 per mug, or $12 each for 6 or more. Yes, we ship. Priority mail flat rate box is $5.25. Checks or PayPal to the San Diego Shell Club at: SDShellClub@gmail.com

The San Diego Shell Club, Inc.
P.O. Box 92023
Encinitas, CA 92023

The new collectible San Diego Shell Club mugs are in. The price is $15 per mug, or $12 each for 6 or more. Yes, we ship. Priority mail small flat rate box is $6.10 in the USA.

The 2016 SDSC calender is now available for $20.00 + $2.08 postage (in the USA). Proceeds will benefit the Club. We know its over a month late, but it is well worth the wait as there are wonderful images of some of the rarest and most unusual shells from the Pacificcoast, some never before illustrated! Get yours today, and tell all your shelling friends.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 1

TABLE OF CONTENTS

ISSN 0738-9388

President's Corner

The 2016 Board of the San Diego Shell Club welcomes you, our members, to an exciting new year filled with interesting speakers, activities and events. Our first two general meetings will continue with the student graduate speaker program, which we started in 2015 - with cutting edge molluscan studies. We will also be adding short Club member presentations on useful skills, techniques and tricks for shellers, and a "show and tell" style portion of each meeting on a different group of shells each month. The end goal is to make our meetings more fun, relevant to all members, and to improve attendance. More shells, fun and people.

The Club's event schedule for 2016 will include all of the old favorites - our April Potluck and Shell Auction, San Diego County Fair display, "Bizarre Bazaar", Balboa Park Show & Sale, end of summer party, November Auction, and holiday party.Your Board has also decided to spice things up this year and hold our first shell show in decades. Why should the east coast have all the fun? We have been in discussions with our friends at the Pacific Conchological Club in Los Angeles about joining forces to put together a great show with displays and entries from the membership of both clubs. The "West Coast Shell Show" has been planned for May of this year and will be advertised both locally and nationally; we were careful to calendar around COA and other major shell shows so that there would be no conflicts. We will have our new Club coffee/tea collectible mugs, new Club pins, supplements and special publications for sale, and hope that all of you participate and/or attend. We will also be organizing a shell fossil collecting field trip this year - please plan on joining us.

This calendar year is about teamwork and inclusion. Because of our Past President's vision, and our Board's dedication we have grown our membership in the last two years, revived some nostalgic events, added new events, attracted new authors to our journal, and revitalized *The Festivus*. Our new Board is committed to making your Club better and stronger. We aim to increase participation in our monthly general meetings as well as our tried-and-true events, and our new events. This year we welcome Bob Abela to the Club's Board. Bob brings with him a ton of skills, talent and new ideas to synergize with the team. Marty Schuler has done a fantastic job as art editor of *The Festivus* and will continue to work with the editorial staff to create attractive and informative covers. We welcome your help in planning Club events - call us.

One of the Club's most important contributions to our mission statement is to produce and publish this journal. More members have been submitting interesting and informative articles in the past two years than ever before, including some of our new members - many of whom have never written an article before. Do you have something to share, like a neat find or a range extension? General interest articles need not be scientific in nature and many of you have been on some really great, fascinating trips and have collected shells or have information, photos, skills or techniques which you can share with your fellow members. This is the forum for just that. This year we kick off with Bill Schramm's beginner article "How I started collecting cowries." Hopefully our biggest problems will continue to be that there simply is not enough space to publish everybody's articles in our future issues.

ISSN 0738-9388

The *Talostolida pellucens* Complex in the Tropical Eastern Pacific: In Perspective (Mollusca: Gastropoda: Cypraeidae)

John D. Daughenbaugh [1] and Marty Beals [2]

[1] 203 North Wilton Place, Los Angeles, CA. 90004
shoduffy@ca.rr.com
[2] 640 South Isis Avenue, Inglewood, CA. 90301
marty@tidelineusa.com

ABSTRACT The Tropical Eastern Pacific (TEP) stretches south from the Gulf of California along the west American mainland and the adjacent coastal areas, and then continues to its terminus in northern Peru. There are also five deep water oceanic islands within the TEP. The TEP coastal area encompasses the coast to the edge of the continental shelf and includes the coastal offshore islands in the Gulf of Panama. The Gulf of California and the Gulf of Panama constitute separate sub-basins within the TEP and contain the greatest diversity of molluscan fauna within the coastal area. The five TEP oceanic islands are defined as: (1) the near atoll of Clipperton, and the islands of Cocos and Malpelo which are centered in the region and (2) the two archipelagos, Revillagigedo and Galapagos which are on the northern and southern peripheries of the TEP. Clipperton is the furthest of the five main oceanic islands from the American mainland at 1,100 km, while Malpelo is the closest at 435 km. All five are volcanic and are separated by abyssal depths from the mainland and each other, and have never been connected.

The Cypraeidae of the TEP, including the *Talostolida pellucens* (Melville, 1888) complex, have only received the attention of scientists in relatively recent times, and only on a sporadic basis. This is due to the remote location of the offshore oceanic islands they inhabit, the difficulty of access, and the challenging collecting conditions which limit that activity. The literature is sparse and, with respect to the *T. pellucens* complex, confusing. While the description of the populations at Clipperton and Cocos Islands provided much current information, some additional perspective will hopefully shed more light on the status of the populations.

INTRODUCTION

The First Records and Reports

Even today, the 1905-1906 Galapagos Expedition of the California Academy of Sciences is regarded as a landmark in our understanding of those islands. However, stops at Clipperton Island on August 10 and at Cocos Island, from September 3 through September 13, 1905, were often overlooked as little of the findings were published. While there was no malacologist among the scientific members of the expedition, the geologist, Washington Henry Ochsner, collected and documented both land and marine shells from the Galapagos Islands. He also collected and recorded *Talostolida* Iredale, 1931 from both Clipperton and Cocos Islands.

L. G. Hertlein first reported Ochsner's 1905 *Talosolida* finding at Clipperton as *Cypraea teres* (Gmelin, 1791) in 1937. Subsequently, he reported *C. teres* among the specimens collected during the 1954 Acapulco Trench

Expedition of the Scripps Institution of Oceanography (Hertlein & Emerson, 1957). Thereafter, the population was referred to as *C. teres*, *C. t. pellucens* or *Blasicrura alisonae* (Burgess, 1983) by various authors. Note: *Blasicrura* Iredale 1930 was changed to *Talostolida* by C. Meyer in 2003 and will be used in this paper throughout, unless quoting other authors. Lorenz & Hubert (1993) preferred *T. pellucens* for the Clipperton population while Emerson & Chaney (1995) preferred *T. alisonae*.

W. H. Ingram reported Ochsner's 1905 Cocos Island find in 1945. He had found a specimen of *Talostolida rashleighana* (Melvill, 1888) "while arranging the Cypraeidae collection of the California Academy of Sciences, Golden Gate Park, San Francisco, California." He noted that "It is a beach shell. The dorsal pattern and coloring are well preserved, and the shell is but slightly eroded."

He wrote: "To date there are two general widely separated areas from which specimens of *C. rashleighana* Melvill have been reported: one of these areas is the Hawaiian Archipelago and the other is New Caledonia and the Loyality Islands, Schilder, 1939. The writer has never seen specimens from the latter area but has collected beach shells of this species from the dredgings of Honolulu Harbor, Oahu, Hawaiian Islands, Ingram, 1937. The Cocos Island record extends the range of this species several hundreds of miles eastward and southward from the Hawaiian Islands and brings it into the fauna of the Western Americas. A close relative of this species, and one found with it in the Hawaiian Islands, is *Cypraea teres* Gmelin, reported earlier from the Western Americas on Clipperton Island, Hertlein, 1937" (Ingram, 1945).

Ingram clearly believed the specimen was synonymous with *T. rashleighana*, one of the most distinctive members of the genus. He also noted its separation from *T. teres*, also found in the Hawaiian Islands. Ingram repeated his findings in 1947.

As no further recorded collecting activities took place at Cocos Island until the early 1980s, all reports prior to then of *T. rashleighana* from Cocos are based on Ingram's finding. Note: By the mid 1980s, based on additional findings and research, it was apparent that Ingram's attribution of the Cocos Island population of *T. pellucens* to *T. rashleighana* was incorrect.

Emerson & Old (1968) figured a *Talostolida* specimen from Panama, one of a number collected in the 1930s by the Allen Hancock Pacific Expedition. They were a small, narrow form, collected alive in association with corals. This population was named *Talostolida pellucens panamensis* (Lorenz, 2002).

Subsequent Developments

In both of Burgess's publications (1970, p. 115, 1985, pp. 148-9), the range of *T. rashleighana* was extended to include Cocos Island. Kay (1979, pp. 197-199) maintains Cocos Island within the distribution of *T. rashleighana*. However, Burgess (1985) states that "Dr Kay does not believe it (*T. rashleighana*) exists as a breeding population outside of the Hawaiian Chain." This must have been based on personal communication because Kay does not hold that position in her 1979 publication as stated by Burgess. Further confusing the issue, Burgess (1985) includes Cocos Island in the distribution map of *T. rashleighana* while, at the same time, introducing *Talostolida alisonae*. He further notes "I have seen conchologically similar cowries from ... Cocos Island off Central America (Dr. D. R. Shasky)."

Talostolida alisonae (Burgess, 1983) was proposed almost entirely on the basis of anatomical differences with *T. teres*. Differences in the papillae were cited as the main difference between the two species, adding that the two species are not separable on conchological characters alone. In addition, Burgess stated that "Shells collected by Emerson and Old in the eastern Pacific are conchologically ***alisonae***, but as in other cases animal studies are not recorded" (Hawaiian Shell News, 1984). Emerson & Old (1968, Plate 12, Figures 1 to 9) figured a specimen from the Galapagos along with the Holotype of *T. alisonae*. The latter is also pictured in the HSN article (p. 3) and Burgess (1985, p. 148). The Holotype bears a striking resemblance to *Talostolida* from Cocos Island. The HSN article and Burgess (1985) formed the basis for collectors of *Talostolida* from Cocos Island to label them *T. alisonae*.

However, descriptions of a species/subspecies on the basis of anatomical characteristics, without supporting consistent conchological characteristics, are problematic at best. Not surprisingly, Lorenz & Hubert (1993) placed *T. alisonae* in synonymy with *T. teres pellucens*, treating the latter as an ecological subspecies. All *teres* complex populations in the TEP were attributed to this subspecies while giving the population from Panama the varietal name *panamensis*.

Emerson & Chaney (1995), while acknowledging Lorenz & Hubert's work, retained the use of *T. alisonae* for TEP populations, pending further elaboration of the characteristics of *T. alisonae* in the TEP. Dr. Chaney's collecting at Cocos Island (1991-1992) and on the offshore islands of western Panama (1993) produced a significant number of specimens of the *T. teres* complex. On that basis, the authors wrote: "All of these cowries had the mantle characters of *B. alisonae* and not of *B. teres*, even though there was considerable variation in shell morphology, expressed as differences in color pattern, growth form, or most importantly, sexual dimorphism. Populations from Cocos Island and western Panama have a similar radular morphology (*teste* Hugh Bradner, June 26, 1993)."

At this point, the Cocos Island population of *T. pellucens* had competing classifications, both of which needed further study and elaboration.

Lorenz (2002, p. 107) elevated *T. teres* and *T. pellucens* to separate species status. He also described *T. p. panamensis*, elevating the variety to subspecies status. The distribution of the subspecies was listed as "Panama, Costa Rica, Mexico and Galapagos." It was further noted that "Shells from Clipperton Is. and Cocos Is. may resemble either typical *teres*, *pellucens* or even *latior*. Their animal characteristics are so far poorly documented. ... Particular attention should be paid to the populations of this species from Natal, the Red Sea, Cocos Is., Clipperton Island, and the Marquesas all of which show subtle features which might indicate validity on some relevant level" (pp. 122-3).

Elaboration and Clarification

Up until 2011, the study of the Cocos Island *Talostolida* population, as well as other TEP populations, had been precluded by a lack of sufficient available specimens with reliable collection data. The exception was specimens from the Panamanian population which became widely available prior to Lorenz (2002). By 2011, the authors had accumulated sufficient specimens from the 1994 Clipperton Island Expedition and the 1980s/90s Expeditions to Cocos Island for a comparative study (Daughenbaugh & Beals, 2013). These

specimens, coupled with the holdings of the Santa Barbara Museum of Natural History, formed the basis for the descriptions of *Talostolida pellucens jacksoni* Daughenbaugh & Beals, 2013 and *Talostolida pellucens sumeihoae* Daughenbaugh & Beals, 2013.

Based on a number of factors which led to the Divergent Evolution of the *T. pellucens* populations in the region (see below), these two new subspecies were described in addition to the subspecies previously described. The distinct conchological features of the individual populations supported subspecies recognition. The features of and holotype photos of each of the subspecies are provided below:

- *Talostolida pellucens jacksoni* (Figure 1) are callous/heavy and oval/cylindrical. Embryonal bands are not visible through the thick basal callus. The labral margin is slightly stepped, the columellar margin mostly well produced with a slightly upturned marginal edge. The aperture is narrow throughout and the peristome concave with a serrated edge at its inner edge. Marginal spotting is distinct and mostly profuse. Dorsal ground coloration pale blue/green.

- *Talostolida pellucens sumeihoae* (Figure 2) are callous/heavy and oval/pyriform. Embryonal bands are not visible through the thick basal callus. The labral groove is stepped; the columellar margin calloused, produced and slightly upturned. The aperture is of intermediate width throughout and the peristome distinct. Marginal spotting is distinct and profuse, especially on the columellar side. Dorsal ground coloration pale blue/green.

- *Talostolida pellucens panamensis* (Figure 3) are lightweight and slender, and nearly cylindrical. Embryonal bands are visible through the thin basal callus. The labral groove is shallow, the columeller margin not calloused. The aperture is wide throughout and the peristome indistinctly ribbed. Marginal spotting is distinct but sparse. Dorsal ground coloration greenish. (Lorenz, pp. 106-7).

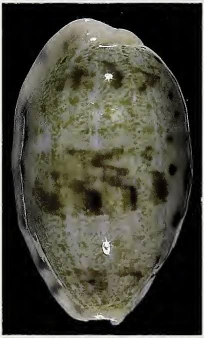


Figure 1. *T. p. jacksoni* holotype

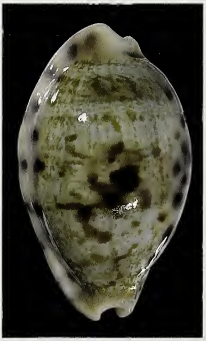


Figure 2. *T. p. sumeihoae* holotype

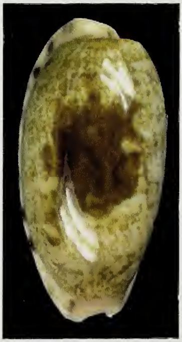


Figure 3. *T. p. panamensis* holotype

	Mantle	Papillae	Siphon
T. p. jacksoni	orange to orange/red, faint lighter blotches, thick/slightly rough	mostly small to large, sparse, light gray to grayish white, banded, slightly tapered, few blunt but mostly 2-4 white or white tipped branches	light orange, translucent, fringed w/ white tips, orange ringed
T. p. sumeihoae	orange/red to red, faint lighter blotches, orange/ brown flecked, thick/slightly rough	large, sparse, grayish white to white, banded, mixture of tapered blunt, and complex white branches	light orange, translucent, fringed
T. p. panamensis	orange/red to red, faint lighter blotches, dark flecked, thick/slightly rough	large, sparse, dark, banded, few blunt but mostly numerous, complex white branches	light orange, translucent, fringed, orange/brown ringed

Prior to the 2013 paper, the animal characteristics of the three subspecies were poorly documented. Fortunately, Dr. Henry Chaney, Santa Barbara Museum of Natural istory (SBMNH), was able to provide excellent animal photos of all three subspecies taken by him on his trips to the region (Figures 4-6). The characteristics are distinct as shown in the table above.

As of 2013, the known distribution for each subspecies was noted as: 1. *T. p. jacksoni* is restricted to Clipperton Island, 2. *T. p. sumeihoae* is restricted to Cocos and Malpelo Islands with the latter likely representing down stream migrants from Cocos, and 3. per Lorenz (2002, p. 107), *T. p. panamensis* ranges from Panama, Costa, Rica, Mexico and Galapagos. However, the authors are not aware of any records or evidence of *T. pellucens* from either Mexico or the Revillagigedo Archipelago.

From the above, one could be forgiven for believing that the taxonomy of the three subspecies is clear cut and not controversial. This would be true for specimens from the type localities of Clipperton Island and Cocos/ Malpelo Islands. However, nature conforms to its own rules which do not necessarily align with those of man.

There has been a recent report of a specimen closely resembling *T. p. sumeihoae* from the coast of Costa Rica (Lorenz, pers. comm.). While we have not examined the specimen, nor verified the accuracy of the collection data, it is possible that this could be a migrant from the Cocos Island population. We would not be surprised if other isolated specimens were found down stream or in areas adjacent to the island. However, there is no indication that this represents a viable population, but is probably a migrant.

***Talostolida pellucens panamensis* Elaborated**

Along with specimens whose features align with those of the type species, there are specimens which do not align with the description of *T. p. panamensis* at the type locality of Cebaco Island and in the type habitat of "depths between 2 and 15 m among rocks and sponges" (Lorenz, p. 107). At Cebaco Island and the adjacent islands in the Gulf of Panama, there are shells which retain the nearly cylindrical shape of *T. p. panamensis* but have a callous base with the callosity extending up onto the margins in some instances. When this occurs, the shape of the shell is extended somewhat laterally and the shell is heavier, but still retains the nearly cylindrical shape of the subspecies. In addition, the marginal spotting is distinct and dense. Some of these shells are noticeably elongate while others more truncated. In all other respects, the shells conform to the type. While relatively rare, these are probably more mature specimens of *T. p. panamensis*.

In addition, there are two specimens in the second author's collection which are similar to *T. p. sumeihoae*. They were collected in 1993 following the moderate 1991-1992 El Nino-Southern Oscillation (ENSO) event. ENSO events result in stronger, faster currents albeit along their normal trajectory. One specimen was collected at Ladrones Island, Panama in January and is indistinguishable from *T. p. sumeihoae*. The other specimen was collected on a seamount off Ladrones Island in April. It shares the features of both *T. p. sumeihoae* and *T. p. panamensis* with the callosity of the former and the elongate shape and coloration of the latter. The authors believe that this specimen represents a hybrid of the two subspecies. The former is a likely migrant from Cocos Island. This hybrid likely represents an early stage of integration into the *T. p. panamensis* gene pool. These are the only two such specimens known to the authors. The authors are not aware of any evidence that a population of *T. p. sumeihoae* has established itself in Panama.

Does the range of *T. p. panamensis* extend to the Galapagos Islands? From February to April each year, the downstream Panama Current flows from the Gulf of Panama to the Galapagos where the molluscan fauna is primarily Panamic (Daughenbaugh & Beals, 2013). As such, one could expect that to find *T. p. panamensis* in the Galapagos. In fact, they are there. While verified *Talostolida* specimens from the Galapagos Islands are rare, the authors have examined six verified specimens (Beals, pers. comm.).

Four specimens were collected at Wolf Island in March, 2005. Two of the specimens align with the description of *T. p. panamensis*, while the other two align more closely with the callous form from the Gulf of Panama. The two callous shells were found under one rock, one is elongate and over 40 mm in length while the other is more truncated. This probably represents sexual dimorphism. Of note, one of the non-callous shells is also over 40 mm in length. In addition to the four Wolf Island shells, two additional specimens were collected on the same trip. One was collected at Cousins Rock while the other was collected at Cape Marshall, Isabella Island. Both shells are the callous form. All six specimens were collected at 6-10 meters, under rocks.

An additional specimen is illustrated by Emerson & Old (1968, Plate 12, Figures 1 to 9) as *Cypraea (Talostolida) teres*. The specimen was reported to have been collected fresh dead off Sombrero, Isla San Salvador, Galapagos Islands at a depth of two fathoms. The specimen is very large at 50 mm and appears to be the callous form of *T. p. panamensis*.

Divergent Evolution

There are three *T. pellucens* subspecies in the TEP, a relatively compact, end of range region. This somewhat surprising happenstance is the result of a number of factors:

1. DNA studies of two *T. p. jacksoni* showed that the Clipperton population had been colonized multiple times from at least two different closely related groups from a southwest (Thailand, Phuket, Marquesas) minor trajectory, meaning that the TEP populations are likely not a single lineage (C. Meyer, pers. comm.).

2. The populations are isolated by:
    - **Biogeography.** The TEP islands are separated by abyssal depths from the mainland and each other and have never been connected.
    - **Distance.** From the Line Islands to Clipperton is 5,700km, from Clipperton to Cocos is 2,375km, from Cocos to the Galapagos is 673km.
    - **Oceanography.** The North Equatorial Counter Current (NECC) flows from the central Pacific Line Islands downstream into the TEP through Clipperton, Cocos, Malpelo and the Gulf of Panama in seriatim. There is little upstream current. However, currents do flow seasonally toward Malpelo Island from the Gulf of Panama and then flow onward to the Galapagos Islands (Glynn, et al.).

3. The short life of the *Erroneinae* Troschel, 1863 lineage larvae in general, and *T. pellucens* specifically (Pauley & Meyer), limits present day dispersal of *T. pellucens* within the TEP.

4. Present day currents are relatively stable and predictable, fostering genetic isolation.

5. The Panama/Galapagos populations inhabit depths between 1-10 meters while the Clipperton and Cocos/Malpelo populations inhabit depths of 10 meters or greater in open ocean settings.

These factors and conditions set the stage for the Divergent Evolution of populations of *T. pellucens* at distinct, separate locales within the TEP. In this case, it is likely that the small number of individual *T. pellucens* veligers which survived to form viable populations were the survivors of a larger influx from a different ecological environment (coral reefs) who were able to adapt to the challenging, largely volcanic conditions existing at varied locales within the TEP. This probably occurred over a relatively short evolutionary time span.

ACKNOWLEDGEMENTS

Dr. Henry Chaney, SBMNH, provided the holotype and a paratype for both *T. p jacksoni* n. ssp. and *T. p. sumeihoae* n. ssp. as well as excellent photos of live *T. pellucens* from the Clipperton, Cocos and Panama populations. We are also indebted to Dr. Chaney for his review of the manuscript, and Virginie Heros of the MNHN in France for images of the *T. p. panamensis* holotype.

REFERENCES

Beals, M. 1995. Cowries of Clipperton. World Shells, 14: 73-76.

Burgess, C. M. 1970. The Living Cowries. A. S. Barnes and Company, Cranbury, New Jersey. 389 pp.

Burgess, C. M. 1983. Another new *Cypraea* in the *teres* complex. Venus, 42(2):183-191, Pl. A-B.

Burgess, C. M. 1985. Cowries of the World. Seacomber Publications, Cape Town: Gordon Verhoef. 289 pp.

Daughenbaugh, J. D. & M. Beals. 2013. Two New Subspecies of *Talostolida pellucens* (Mellvill, 1888) from the Tropical Eastern Pacific (Mollisca: Cypraeidae). Conchylia 43 (1-4), 77-89, Pl. 1-4.

Emerson, W. K. & H.W. Chaney. 1995. A Zoogeographic Review of the Cypraeidae (Mollusca: Gastropoda) Occurring in the Eastern Pacific Ocean. The Veliger, 38 (1): 8-21.

Glynn, P. W., Veron, J. E. N. & G.M. Wellington. 1996. Clipperton Atoll (eastern Pacific): oceanography, geomorphology, reef-building coral ecology and biogeography. Coral Reefs, 15 (2):71-99.

Hertlein, L. G. 1937. A note on some species of marine mollusks occurring in both Polynesia and the Western Americas. Proceedings of the American Philosophical Society, 78(2):303-312.

Hertlein, L. G. & W.K. Emerson. 1957. Additional Notes on the Invertebrate Fauna of Clipperton Island. American Museum Novitates, 1859:1-9.

Ingram, W. M. 1937. The family Cypraeidae in the Hawaiian Islands. The Nautilus, 50(3):77-82.

Ingram, W. M. 1945. An Extension of the Range of Cypraea Rashleighana Melvill. The Nautilus, 58(3):106.

Ingram, W. M. 1947. *Cypraea rashleighana* Melvill. Bulletins of American Paleontology, XXXI (120):76.

Kaiser, K. L. 2001. The Recent Molluscan Marine Fauna of Isla de Malpelo, Columbia. The Festivus XXXIII (Supplement): 152 pp., 54 pls.

Kaiser, K. L. 1997. The Recent Molluscan Fauna of I'le Clipperton (Tropical Eastern Pacific). The Festivus, XXXIX (Supplement): 162 pp., 42 pls.

Kay, E. A. 1979. Hawaiian Marine Shells, Reef and Shore Fauna of Hawaii, Section 4: Mollusca. Bishop Museum Press, Honolulu, Hawaii. 653 pp.

Lillico, S. 1984. *Cypraea alisonae*, the Shell that used to be called *C. teres*. Hawaiian Shell News, April: 3.

Lorenz F. & A. Hubert. 1993. A Guide to Worldwide Cowries. Conchbooks, Hackenheim, Germany. 584 pp., 128 pls.

Lorenz, F. 2002. New Worldwide Cowries. Conchbooks, Hackenheim, Germany. 292 pp., 40 pls.

Meyer, C. P. 2003. Molecular Systematics of Cowries (Gastropoda:Cypraeidae) and Diversification Patterns in the Tropics. Biological Journal of the Linnean Society, 79:401-459.

Pauley, G. & C.P. Meyer. 2006. Dispersal and Divergence Across the Greatest Ocean Region: Do Larvae Matter? Integrative and Comparative Biology, 46(3):269-281.

Schilder, F. A. & M. Schilder. 1939. Prodome of a Monograph on Living Cypraeidae. Proceedings of the Malacological Society, 23(5):119-231.

ISSN 0738-9388

Figure 4. *T. pellucens jacksoni*, Clipperton Island. Photo by Dr. Hank Chaney.

Figure 5. *T. pellucens sumeihoae*, Cocos Island. Photo by Dr. Hank Chaney.

Figure 6. *T. pellucens panamensis*, Panama. Photo by Dr. Hank Chaney.

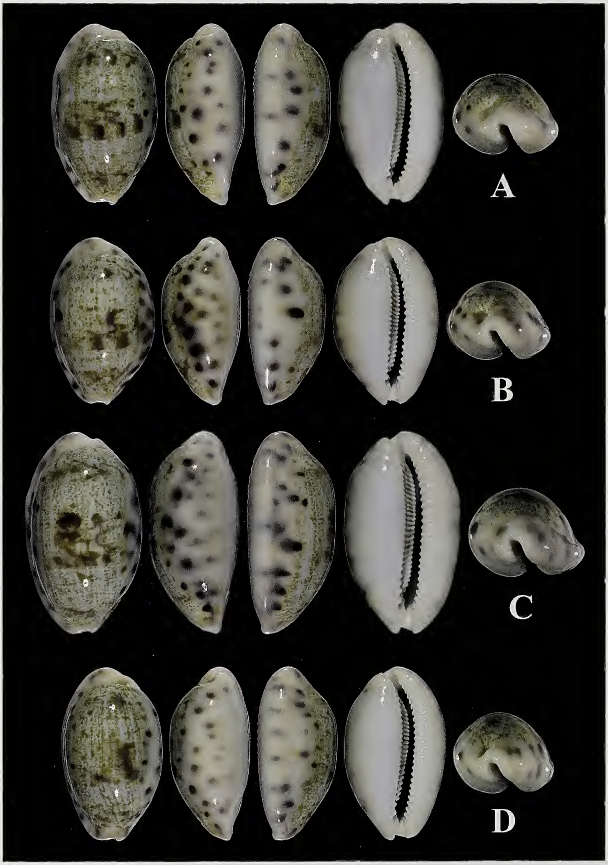


Figure 7: *T. pellucens jacksoni* specimens. A = holotype 34.8mm; B = paratype 2, 32.0mm; C = paratype 3, 38.7mm; D = paratype 5, 33.2mm.

ISSN 0738-9388

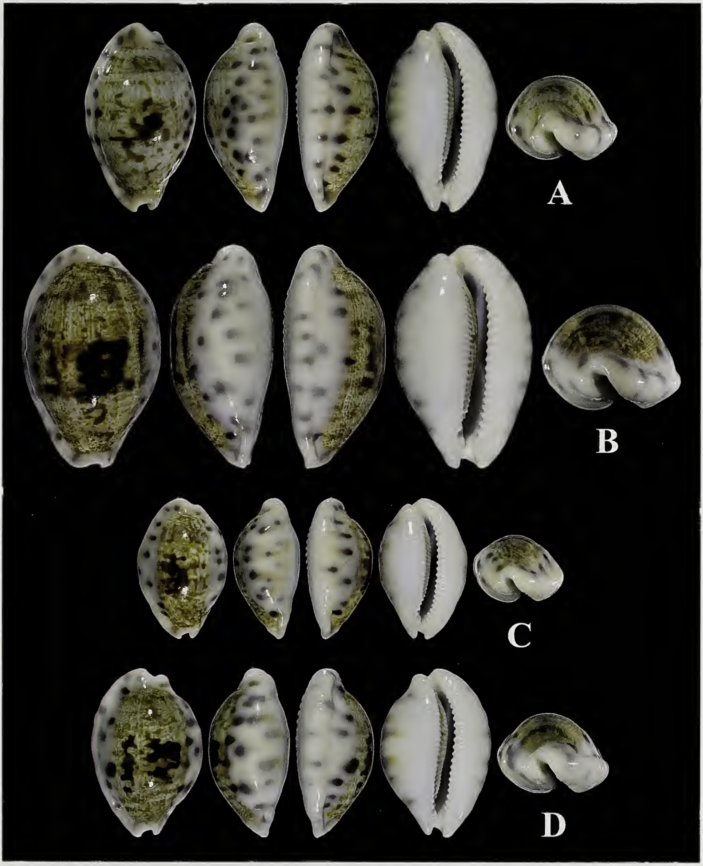


Figure 8: *T. pellucens sumeihoae* specimens. A = holotype 35.4mm, B = paratype 2, 42.0mm, C = paratype 6, 26.7mm, D = *T. pellucens sumeihoae* paratype 9, 32.0mm.

ISSN 0738-9388

Figure 9: *T. pellucens panamensis* specimens. Top row = holotype, 26.8mm, dorsal, ventral and side views; Second row = Sebaco Island 27.3mm, Contreras Island 34.9mm, Contreras Island 30.8mm dorsal and ventral views; Third row = Sebaco Island 42.1mm, Sebaco Island 35.0mm, Secas Island 41.5mm dorsal and ventral views; Fourth row = Sebaco Island 34.6mm dorsal and ventral views, off Ladrones Island 38.1mm dorsal and ventral views.

ISSN 0738-9388

Figure 10: Top row = *T. pellucens sumeihoae* Cocos Island 37.6mm, *T. pellucens sumeihoae* x *T. pellucens panamensis* off Ladrones Island, Panama 38.7mm, *T. pellucens sumeihoae* Ladrones Island, Panama 34.2mm; Second row = *T. pellucens panamensis* Las Perlas Islands, Panama 38.0mm and 34.1mm, Wolf Island, Galapagos 44.2mm and 34.4mm; Third row = *T. pellucens panamensis* Wolf Island, Galapagos 43.3mm dorsal and ventral views, Cousins Rock, Galapagos 36.1mm, and Isabella Island, Galapagos 33.3mm.

ISSN 0738-9388

Corbicula fluminea (O. F. Müller, 1774), an Invasive Bivalve Mollusk, First Identified at Numerous Sites in Bangladesh

Gulshan Ara Latifa[1], Abu Tweb Abu Ahmed[1], Md. Sagir Ahmed[1], Mohammed Abdul Baki[2], and Md. Muzammel Hossain*[1]

[1] Department of Zoology, University of Dhaka, Dhaka-1000, Bangladesh
[2] Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh
* Corresponding author: muzammel3@gmail.com

ABSTRACT While identifying Invasive Alien Species (IAS) from different locations and aquatic habitats in Bangladesh, *Corbicula fluminea* (O. F. Müller, 1774), an invasive alien species belonging to the family Cyrenidae was recorded for the first time. Significant impacts caused by this invasive species were detected in a number of different habitats (river side, lake side, wetland, and stream) in Bangladesh.

KEY WORDS: Invasive alien species, Mollusca, *Corbicula fluminea,* Bangladesh.

INTRODUCTION

The first collection of *Corbicula fluminea* in the United States occurred in 1938 along the banks of the Columbia River near Knappton, Washington (Counts 1986). The original distribution of the *Corbicula* genus was confined, in the beginning of the last century, to Asia, Africa and Australia and since then it has dispersed worldwide (Mouthon 1981, Counts 1986, Araujo *et al.* 1993, Ituarte 1994, McMahon 2000). The first documented occurrence of this genus outside its original distribution was on the Pacific coast of the United States in the 1920s, possibly being introduced by Chinese immigrants as a food resource (Counts 1981). Alternatively, it may have come in with the importation of the Giant Pacific oyster also from Asia. It is known mostly as a biofouler of many electrical and nuclear power plants across the country. As water is drawn from rivers, streams, and reservoirs for cooling purposes so are *Corbicula* larvae. Once inside the plant, this mussel can clog condenser tubes, raw service water pipes, and firefighting equipment. Economic problems can result from the decreased efficiency of energy generation. Warm water effluents at these power plants make a hospitable environment for stabilizing populations. Humans are the primary agent of dispersal, and no large-scale geographic features function as barriers to dispersal (Counts 1986, Isom 1986). Current methods of introduction include bait bucket introductions, accidental introductions associated with imported aquaculture species (Counts 1986), and intentional introductions by people who sell them as a food item in markets (Devick 1991). The only other significant dispersal agent is thought to be passive movement via water currents (Isom 1986); fish and birds are not considered to be significant distribution vectors (Counts 1986, Isom 1986). *Corbicula fluminea* is consumed mainly by fish and crayfish. An account of the different species which prey on *C. fluminea* in the USA was presented by McMahon in1983. The most prominent effect of the introduction of the Asian clam has been biofouling, especially of complex power plant and industrial water systems (Isom, *et al.* 1986;

Williams and McMahon 1986). It has also been documented to cause problems in irrigation canals and pipes (Prokopovich and Hebert 1965; Devick 1991) and drinking water supplies (Smith *et al.* 1979). It also alters benthic substrates (Sickel 1986), and competes with native species for limited resources (Devick 1991). Diver assisted suction removal and bottom barriers are being researched as potential methods for physical control of *Corbicula* populations in Lake Tahoe (UC Davis TERC, 2004). Benthic barriers have been demonstrated to be effective for short-term control of *C. fluminea*, but non-target mortality to other benthic invertebrates can be high (Wittmann *et al.*, 2012).

Invasive species, whether called nonnative, alien, exotic, non-indigenous or introduced are those life forms that have evolved elsewhere and been purposely or accidentally moved to a new location. The invasive species spread quickly and easily in the new environment, as there are no natural predators. In their native habitats, these species are often harmless. However, when they enter new environment, for example water where natural controls are absent, they may out-compete native plants and animals. So far 22 freshwater mollusk have been recorded from Bangladesh (Siddiqui *et al.*, 2008). During 2011 to 2012, a total of 15 freshwater mollusk (10 gastropod and 5 bivalve species) were identified in the Old Brahmaputra river, Mymensingh, Bangladesh (Hossain and Baki 2014). To date there has been no evaluation of *C. fluminea* in the tropical Bangladesh area, until this study.

MATERIALS AND METHODS

Invertebrate samples were collected by hand from different locations in Bangladesh from May 2014 to August 2015. Invertebrate samples were also collected by fishermen during fishing season on river banks. Samples were identified by the Department of Zoology, University of Dhaka; Department of Zoology, Jagannath University, Bangladesh, and by the authors Sousa *et al.* 2008. Specimens were photographed with a Nikon D3200 DSLR camera.

RESULTS AND DISCUSSION

This study was the first to record and document *C. fluminea* (O. F. Müller, 1774) from a variety of habitats and locations in Bangladesh. (VSN0017/BR/FM/JnUZM;VSN 006/FM/DUZM).

Common Name: Asian clam, golden clam.
Classification: Kingdom: Animalia; Phylum: Mollusca; Class: Bivalvia; Subclass: Heterodonta; Order: Veneroida; Super Family: Cyrenoidea; Family: Cyrenidae; Genus: *Corbicula*; Species: *Corbicula fluminea.*

Morphology: This freshwater bivalve mollusk has distinct concentric rows of elevated ridges on the exterior of the shell. The shell is rounded to slightly triangular. Each valve has three cardinal teeth; the outside of the shell is transparent or yellow brown in color while alive; the inside of the shell is polished and a grey to light purple color when alive and dark brown when dead; thick, with distinct elevated rings on the exterior of the shell. The size ranges from approximately 2.5 to 3cm in length.

Habitat and Ecology: *Corbicula fluminea* occurs in sandy, muddy or gravel-bottomed streams, rivers, ponds and shallow lake shorelines. It can tolerate a wide range of environmental conditions in tropical ecosystem. It lives in streams, as well as hilly areas with wetlands at depths of 0.9 to 3m and in approximately 17.8 cm of sediment. This

clam is a filter feeder that removes particles from the water column. It is found on the benthic sediment surface or slightly beneath it. The ability of *Corbicula* to reproduce rapidly, coupled with its low tolerance of cold temperatures (2-30°C), can produce wild swings in population sizes from year to year in northern water bodies. Both yellow and brown morphs occur simultaneous as this species is hermaphroditic and broods its larvae in the inner demibranchs (Qiu *et al.* 2001).

Figure 1. *Corbicula fluminea* (O. F. Müller, 1774) (shows both green and yellow-brown morphs).

Life history: Life span is 1 to 5 years, age at maturity is 3 to 9 months, fecundity 68 678, Juvenile size at release 250 µm, position of broods inner demibranchs, type of released larvae (juveniles) D-shaped configuration, brooding type synchronous, juvenile survivorship low, adult survivorship usually low, number of reproductive events usually two but may vary, assimilated energy respired 11 - 42 %, non-respired energy transferred to growth 58 - 71 %, non-respired energy transferred to reproduction 5 - 15 % (Sousa *et al.* 2008).

Habitat requirements: Tolerate low water temperatures and prefer sandier sediments mixed with silt and clay (which enhance the organic matter content). Intolerant to high salinity and even moderate hypoxia conditions (this species is usually restricted to well-oxygenated areas). However, in some ecosystems this species can be found in all types of sediments (with or without submerged vegetation) (Sousa *et al.* 2008).

Distribution: *Corbicula fluminea* was found in:

Kamrangichar, Buriganga River (GPS 90°35′07.9′′E and 23°74′11.79′′N) and the portion of Buriganga River flowing through the heart of the Dhaka city, at an average depth of 7.6 metres (25 ft) and a maximum depth of 18 metres (58 ft); during 2012 to 2013 under the MS Research grant program of Dept. of Zoology, JnU.

Old Brahmaputra River, Mymensingh, (GPS 90°37′59.93′′E and 24°19′25.35′′N) originates from the left bank of the Brahmaputra to the north of Bahadurabad. Flowing more or less to the southeast it passes the cities of Jamalpur and Mymensingh and joins into the Meghna at Bhairab Bazar Kaptai Lake, Rangamati (GPS 92°12′49.78′′E

ISSN 0738-9388

Figure 2. Distribution of Invasive Species *Corbicula fluminea* (O. F. Müller, 1774) in Banglasdesh.

and 22°35′33.96′′N), a man-made lake with an average depth of 30 meters in south-eastern Bangladesh. The lake is located in the Kaptai Upazila under Rangamati District of Chittagong Division.

Karnaphuli River (GPS 91°48′ E and 22°15′ N; 91°52′ E and 22°20′ N) which is the largest and most important river in Chittagong, and the Chittagong Hill Tracts, is a 667-metre wide river in the south-eastern region.

Tanguar Haor, Sunamganj (GPS 91°04′12.7′′E and 25°08′45.3′′N), is located in the Dharmapasha and Tahirpur upazilas of Sunamganj District in Bangladesh. This is a unique wetland ecosystem of national importance and has come into international focus.

Punarbhaba River, Dinajpur (GPS 88°37′20.39′′E and 25°37′33.18′′N), is situated between Bangladesh and West Bengal in India. It is about 160 kilometres in length and 3 to 8 kilometres wide, having a mean depth of 1.96 meters, and originates from the lowlands of Thakurgaon District of Bangladesh (Figures 1 & 2).

Water Quality: During October 2012 to August 2013, the water quality parameters of the Buriganga River namely temperature, pH, salinity, TDS, EC, DO and COD were 22.0-31.6°C, 6.2-7.8, 69-642 mg/l, 97-871 mg/l, 146-1309 µs, 1.1-4.1 mg/l and 140-800 mg/l respectively (Sarkar *et al.,* 2015). In April 2008, surface water quality parameters of Kaptai reservoir such as, pH, TDS, DO and COD were 5.7-6.4, 50-120 mg/l, 6.58-6.66 mg/l and 8.00-15.00 mg/l (Karmaka *et. al.,* 2011). In May to June 2012, the water quality in this region specifically the temperature, pH, DO and TDS in Tanguar Haor, were 27.8-28, 6.9-7.6, 4.5-5.5 mg/l and 670-1036 mg/l respectively (Mamun *et. al.,* 2013).

CONCLUSION

Corbicula fluminea has become a major component of benthic communities in several lotic and lentic habitats in different regions of the world and, thus, has wide spatial distributions. It may be found in both pristine and polluted environments, and presents a very strong invasive dynamics in rivers, channels and lakes where it reaches very high abundance (Phelps 1994, Sousa *et al.* 2008). *Corbicula fluminea* is a bioindicator species for ecotoxicological studies (Doherty 1990, Inza *et al.* 1997, Cataldo *et al.* 2001) and food resource for pelagic and benthic species (Cantanhêde *et al.* 2008). *Corbicula fluminea*'s abundance, biomass and abiotic factors will be important for future risk analysis. This study has increased our knowledge about an important ecological processes mediated by *C. fluminea* that can be responsible for changes in the functioning of

the aquatic ecosystem. In spite of the information presented here there is still considerable need for further research on water quality, habitat, population and abundance of the species.

ACKNOWLEDGEMENTS

This research was supported by Faunal Survey and Enrichment of Facilities for Biodiversity Research Sub-Project (CP 2216), HEQEP, UGC, Bangladesh and Department of Zoology, University of Dhaka. Also, acknowledgement is extended to Department of Zoology, Jagannath University, Dhaka that provided information about Invasive Alien Species (IAS).

REFERENCES

Araujo R., D. Moreno & M.A. Ramos. 1993. The asiatic clam *Corbicula fluminea* (Müller, 1774) (Bivalvia: Corbiculidae) in Europe. *Am. Malacol. Bull.,* 10:39-49.

Cataldo D., J.C. Colombo, D. Boltovskoy, C. Bilos & P. Landoni .2001. Environmental toxicity assessment in the Paraná river delta (Argentina): simultaneous evaluation of selected pollutants and mortality rates of *Corbicula fluminea* (Bivalvia) early juveniles. *Environ. Pollut.,* 112:379-389.

Cantanhêde G., N.S. Hahn, É.A. Gubiani & R. Fugi . 2008. Invasive molluscs in the diet of Pterodorasgranulosus (Valenciennes, 1821) (Pisces, Doradidae) in the Upper Paraná River floodplain, Brazil. *Ecol. Freshw. Fish*, 17:47-53.

Counts C.L. 1981. *Corbicula fluminea* (Bivalvia: Corbiculidea) in British Columbia. *Nautilus*, 95:12-13.

Counts, C.L., III. 1986. The zoogeography and history of the invasion of the United States by *Corbicula fluminea* (Bivalvia: Corbiculidae). *Am. Malacol. Bull.*, Special Edition No. 2:7-39.

Devick, W.S. 1991. Patterns of introductions of aquatic organisms to Hawaiian freshwater habitats. Pages 189-213, in New Directions in Research, Management and Conservation of Hawaiian Freshwater Stream Ecosystem. Proceedings Freshwater Stream Biology and Fisheries Management Symposium. Department of Land and Natural Resources, Division of Aquatic Resources, Honolulu, HI.

Doherty F.G. 1990. The Asiatic clam, *Corbicula* spp. as a biological monitor in freshwater environments. *Environ. Monit. Assess.*, 15:143-181.

Hossain M.M., & M.A. Baki. 2014. A preliminary survey of freshwater mollusca (gastropoda and bivalva) and distribution in the river Brahmaputra, Mymensingh, Bangladesh. *The Journal of Zoology Studies*, 1(3):19-22.

Inza B., F. Ribeyre, R. Maury-Brachet & A. Boudou. 1997. Tissue distribution of inorganic mercury, methilmercury and cadmium in the Asiatic clam (*Corbicula fluminea*) in relation to the contamination levels of the water column and sediment. *Chemosphere*, 35:2817-2836.

Isom, B.G. 1986. Historical review of Asiatic clam (*Corbicula*) invasion and biofouling of waters and industries in the Americas. *Am. Malacol. Bull.*, Special Edition No. 2:1-5.

Isom, B.G., C.F. Bowman, J.T. Johnson, & E.B. Rodgers. 1986. Controlling *Corbicula* (Asiatic clams) in complex power plant and industrial water systems. *American Malacological Bulletin*, Special Edition 2:95-98.

Ituarte C.F. 1994. *Corbicula* and *Neocorbicula* (Bivalvia: Corbiculidae) in the Paraná, Uruguay, and Rio de la Plata Basins. *Nautilus*, 107:129-135.

Karmakar, S., S. M. Sirajul Haque, M. Mozaffar Hossain, & M. Shafiq. 2011. Water quality of Kaptai reservoir in Chittagong Hill Tracts of Bangladesh. *Journal of Forestry Research* 22(1):87-92. DOI 10.1007/s11676-011-0131-6.

Mamun, S. A., S. Roy, M. S. Rahaman, Jahan & M. S. Islam. 2013. Status of Fisheries Resources and Water Quality of Tanguar Haor. *J. Environ. Sci. & Natural Resources*, 6(1):103-106.

McMahon, R.F. 1983. Ecology of an invasive pest bivalve, *Corbicula*. In W.D. Russell-Hunter (ed.), The Mollusca, Vol. Ecology, Academic Press, NY, pp. 505-561.

McMahon R.F. 2000. Invasive characteristics of the freshwater bivalve *Corbicula fluminea*. Pages 315-343 in Nonindigenous Freshwater Organisms: Vectors, Biology and Impacts. Claudi R. & Leach J. (eds). Lewis Publishers, Boca Raton.

Mouthon J. 1981. Sur la présence en France et au Portugal de Corbicula (Bivalvia, Corbiculidae) originaire d'Asie. Basteria, 45:109-116.

Prokopovich, N.P., & D.J. Hebert. 1965. Sedimentation in the Delta-Mendota Canal. *Journal of the American Water Works Association* 57:375-382.

Phelps H.L. 1994. The Asiatic clam (*Corbicula fluminea*) invasion and system-level ecological change in the Potomac River Estuary near Washington, D.C. Estuaries, 17:614-621.

Qiu, A., A. Shi, & A. Komaru. 2001. Yellow and brown shell color morphs of *Corbicula fluminea* (Bivalvia: Corbiculidae) from Sichuan Province, China, are triploids and tetraploids. Journal of Shellfish Research 20:323-328.

Sarkar, M., A.K.M.L. Rahman, J.B. Islam, K.S. Ahmed, M.N. Uddin, & N. C. Bhoumik. 2015. Study of hydrochemistry and pollution status of the Buriganga river, Bangladesh. *Bangladesh J. Sci. Ind. Res.* 50(2):123-134.

Siddiqui, K.U., M.A. Islam, S.M.H. Kabir, M. Ahmed, A.T.A. Ahmed, A.K.A. Rahman, E.U. Haque, Z.U. Ahmed, Z.N.T. Begum, M.A. Hassan, M. Khondker, & M.M. Rahman (eds.) 2008. Encyclopedia of Flora and Fauna of Bangladesh, Vol.17. Molluscs.Asiatic Society of Bangladesh, Dhaka 415 pp.

Sickel, J.B. 1986. *Corbicula* population mortalities: factors influencing population control. *Am. Malacol. Bull.*, Special Edition 2:89-94.

Smith, A.L., A. Mula, J.P. Farkas, & D.O. Bassett. 1979. Clams - a growing threat to in plant water systems. *Plant Engineering* 1979:165-167.

Sousa, R., C. Antunes, & L. Guilhermino. 2008. Ecology of the invasive Asian clam *Corbicula fluminea* (Muller, 1774) in aquatic ecosystems: an overview. *Ann. Limnol. – Int. J. Lim.* 44(2): 85-94.

UC Davis Tahoe Environmental Research Center. 2004. Aquatic Invasive Species. Accessed,10/28/13. http://terc.ucdavis.edu/research/aquaticinvasives.html.

Williams, C.J., & R.F. McMahon. 1986. Power station entrainment of *Corbicula fluminea* (Müller) in relation to population dynamics, reproductive cycle and biotic and abiotic variables. *American Malacological Bulletin*, Special Edition 2:99-111.

Wittmann, M.E. S. Chandra, J.E. Reuter, S.G. Schladow, B.C. Allen, & K.J. Webb. 2012. The control of an invasive bivalve, *Corbicula fluminea*, using gas impermeable benthic barriers in a large natural lake. *Environmental Management* 49(6):1163-73.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 1

A Study on Olive Shells – 2: *Oliva hirasei* Kuroda & Habe, 1952, and Its New Subspecies from Pangandaran Bay, Java, Indonesia

Giorgio Strano
Museo Galileo: Institute and Museum of History of Science
Piazza dei Giudici 1, 50122 Firenze, Italy
g.strano@museogalileo.it

INTRODUCTION

The number of *Oliva* species varies continuously from one author to another. There is perhaps no other gastropod group where the uncertainty of the synonymy is proportional to the beauty of the shells. Whoever studies olives and finds something neglected in the monographs on the genus should pause for a while and then carefully reflect. Is what one has in hand a new species or subspecies, or just a color form or variety already described elsewhere?

During the last five years, a few dealers offered a total of about thirty noteworthy specimens of *Oliva hirasei* Kuroda & Habe, 1952. Such specimens share two features. They have a bright purple aperture, very different from the off white aperture of the species. They come from Pangandaran Bay, S.W. Java, Indonesia, a locality outside the acknowledged distribution range of *O. hirasei*.

The availability of 17 specimens for direct analysis made it apparent that these shells differ from the typical *O. hirasei* also for other morphometric and morphological characters. So far, the evidence is strong enough to distinguish between *O. hirasei hirasei* and a new, geographically secluded new subspecies, *O. hirasei ameliae*.

Historical background

Several common and bathymetrically accessible Olives had to wait until the 20th century to gain the specialist's attention. The case of *O. hirasei* is noteworthy because, in addition to its wide distribution and present availability, the species is of medium size and relatively constant in shape, color and pattern.

The study of pre-20th-century sources confirms that no specimen of *O. hirasei* had therein been described under another name. The first figured specimen appeared in 1909, in one of Yoichiro Hirase's bilingual articles on the mollusks of Japan [Hirase, 1909: pl. 4, fig. 26] **(Figure 1a)**. Hirase guessed that this "Kuchijiro-makura" from the Okinawa islands could be a variety of *O. irisans* Lamarck, 1811. He also remarked: "Somewhat this resembles *O. scripta* Lam., but not exact" [*Ibid.*: 15]. A short description and comparisons with "Judou-makura" — called *O. irisans*, but being *O. miniacea miniacea* (Röding, 1798) — and "Numeri-makura" — the true *O. irisans* — were placed in the Japanese section of the article [*Ibid.*: 46].

The name *O. hirasei* was coined by Tokubei Kuroda and Tadashige Habe in their *Check List* of the marine mollusks of Japan. In 1952, the two authors acknowledged that the shell was the same described by Hirase, made explicit reference to his figure of 1909, and implicitly dedicated the new species to his memory [Kuroda & Habe, 1952: 74].

ISSN 0738-9388

Two years later, Tetsuaki Kira published the first edition of his *Coloured Illustrations of the Shells of Japan*. The volume included a new description of "Kuchijiro-makura", or "*O. hirasei* Kuroda, MS", and a new figure [Kira, 1954: 63 and pl. 31, fig. 8]. A second edition of the book was printed in 1959 and, again, included the description, the attribution to Kuroda and the figure [Kira, 1959: 80 and pl. 31, fig. 8] **(Figure 1b)**. It is uncertain which of the two editions was available to John Q. Burch and Rose L. Burch. On the basis of Hirase, Kuroda and Habe, and Kira, they suggested that the new taxon, to be called *O. hirasei* Kuroda & Habe, 1952, could be a synonym of *O. tremulina* Lamarck, 1811 [Burch & Burch, 1959: 12; and 1960: 19]. In fact, before the revision of the genus *Oliva* Bruguière, 1789, by Edward J. Petuch and Dennis M. Sargent, *O. tremulina* was usually identified with the present *O. concinna* Marrat, 1870 [Zeigler & Porreca, 1969: pl. 12, figs. 1-7]. The rough similarity between orange specimens of *O. concinna oldi* Zeigler, 1969, and *O. hirasei* explains the perplexities on the past, and also why actual specimens of *O. hirasei* were taken for *O. tremulina fumosa* Marrat, 1871 [*Ibid.*: pl. 12, fig. 8].

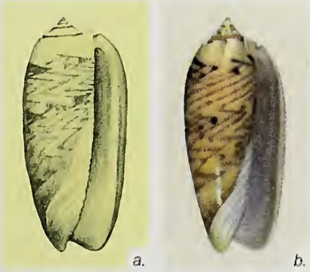


Figure 1. The Japanese shell "Kuchijiro-makura"; **a.** The first figured specimen [Hirase, 1909: pl. 4, fig. 26; from www.biodiversitylibrary.org]; **b.** The second figured specimen [Kira, 1954 and 1959: pl. 31, fig. 8].

Even if the shell was successively neglected, or perhaps considered a Japanese form of alleged *O. scripta* Lamarck, 1811 [Burch & Burch, 1967: 516], Rowland F. Zeigler and Humbert C. Porreca stated that *O. hirasei* was a valid species. In 1969, they outlined that "apparently there is no written description of the shell by Kuroda and Habe". Kira had to be credited for the first description in 1959, and "Kuroda, MS", could represent an incomplete reference to Kuroda and Habe. As a consequence, they coined the name: *O. hirasei* "Kuroda & Habe, 1952" Kira, 1959 [*Ibid.*: 71], and paved the way to further errors. On the one hand, Petuch and Sargent split the name into *O. hirasei* Kuroda and Habe, 1952 [Petuch & Sargent, 1986: 248] and *O. hirasei* Kira, 1959 [*Ibid.*: 52, 92 and 181]. On the other hand, Bernard Tursch and Dietmar Greifeneder made unsound inferences. First: Kuorda and Habe did not describe the species. Therefore, according to the *ICZN*, Art. 13.1.1, *O. hirasei* Kuorda & Habe, 1952, was a *nomen nudum*. Second: the attribution of *O. hirasei* to "Kuroda, MS" possibly referred to a description by Kuroda in Kira's journal *Yume-hamaguri*. According to the *ICZN*, Art. 9.1, "after 1930 handwriting reproduced in facsimile by any process"—as it was the case of *Yume-hamaguri*—do not constitute publication. Therefore, Kuroda's contribution to the taxon was irrelevant and Kira had the full merit of the first description. Third: Tursch and Greifeneder examined the 1959 second edition of the *Coloured Illustrations*, instead of the 1954 first edition. As a result, they concluded that *O. hirasei* Kira, 1959, was the name of the taxon [Tursch & Greifeneder, 1996: 23-24; and 2001: 447]. Such a name was blindly accepted in the two most recent monographs on Olive shells [Sterba, 2003: 54; Hunon, Hoarau & Robin, 2009: 106].

It is important to note that, to be available, any new name published after 1930 must be accompanied either "by a description or definition that states in words characters that are purported to differentiate the taxon" [*ICZN*: Art. 13.1.1], or "by a bibliographic reference to such a published statement" [*ICZN*: Art. 13.1.2]. When, in 1952, Kuroda and Habe cited Hirase's figure of 1909, they inevitably included the bibliographic reference to Hirase's bilingual description of the shell, even if it was considered a variety of *O. irisans*. In this way, they accomplished a valid taxonomical act in the spirit of the *ICZN*, Art. 13.1.2. Such an act makes *O. hirasei* Kuroda & Habe, 1952, the correct name of the taxon [Rüdiger & Petit, 1990: 139].

Oliva hirasei hirasei **Kuroda & Habe, 1952**
For a better intelligibility of *O. hirasei ameliae*, new subspecies, I resume the general characters of the typical subspecies *O. hirasei hirasei*:

***Description*:** Shell elongated, sub-cylindrical. Width/Hight ratio 44.59 % ± 1.79 %. Nucleus formed by ca. 3.8 (usually worn) whorls. Spire very low, 6.79 % ± 1.54 % of the shell; profile from slightly concave to sunken; from 4.5 to 5.1 whorls (body whorl included). Filament channel open. Spire/shoulder transition barely telescopic. Aperture narrow, very long, 91.65 % ± 3.29 % of the shell. Parietal wall straight or slightly concave. From 22 to 38 usually well-developed plicae, rarely smoothed; sequence [see Tursch & Greifeneder, 2001: 295]: 4-11/2-6/1-5/11-21. Shell's overall color cream. Sub-channel pattern formed by faint irregular marks which may develop into a continuous dark line. Pattern-less spire callus, tan. Body-whorl pattern formed by a broad, regular reticulation of brown speckles and light triangles. Pattern-less area at the shoulder. Posterior and middle bands always present, from scantly to well developed, formed by irregular brown blotches. External glaze usually present, from yellow to tan. Post-fasciole band bipartite, posteriorly translucent and mostly pattern-less, anteriorly with dense regular brown strokes. Parietal callus from translucent towards the spire to off white around the centre. Fasciole off white. Anterior tip with a tan diffuse area. Lip from cream to tan. Aperture off white, sometimes with a bluish hue. Siphon notch white (see **Figure 2**).

***Size*:** up to 70.2 mm; usually around 50 mm.

***Type material*:** The 1909 figured specimen, ca. 45 mm high, belonged in Hirase's collection, originally placed in The Hirase Conchological Museum of Kyoto. The collection was moved to the Science Museum in Ueno Park (today's National Museum of Nature and Science), Tokyo, and survived World War II [Clench, 1948: 35]. The present existence of the figured specimen needs, however, confirmation.

***Type locality*:** Okinawa, Ryukyu Is., S. Japan.

***Distribution*:** S. Japan, Taiwan, Vietnam, Philippines, N. Borneo, Melanesia up to New Caledonia.

***Bathymetric range*:** From shallow to deep water, between 2 and 160 m.

***Oliva hirasei ameliae*, new subspecies**

For the sake of clarity, I will describe the type material of *O. hirasei ameliae*, new subspecies, along the same lines of *O. hirasei hirasei*.

Description: Shell elongated, sub-cylindrical or sub-conical. Width/Hight ratio 44.12 % ± 0.96 %. Nucleus formed by about 3.7 (usually worn) whorls. Spire low, 7.66 % ± 1.14 % of the shell; profile slightly concave; from 4.1 to 5.0 whorls. Filament channel open. Spire/shoulder transition barely telescopic. Aperture narrow, long, 88.97 % ± 2.18 % of the shell. Parietal wall straight or slightly concave. From 24 to 34 well-developed plicae; sequence: 5-9/3-5/2-4/11-19. Shell's overall color ivory white. Sub-channel pattern formed by faint marks which may develop into an interrupted purple line. Pattern-less spire callus, from tan to violet. Body-whorl pattern formed by a broad, regular reticulation of brown speckles and light triangles. Pattern-less area at the shoulder. Posterior and middle bands always present, often well developed, rarely coalescing, formed by irregular brown blotches. External glaze seldom present, light yellow. Post-fasciole band bipartite, posteriorly translucent and mostly pattern-less, anteriorly with a few brown strokes. Parietal callus from translucent towards the spire to white around the centre. Fasciole white. Anterior tip with a yellow diffuse area. Lip from light cream to ivory white outside, white inside. Aperture with a broad bright purple longitudinal band. Throat white. Siphon notch violet (see **Figures 3 and 4**).

Size: up to 45.6 mm; usually around 40 mm.

Type material: Holotype: collected in 2009, 41.2 mm; Museum of Natural History "La Specola", Firenze, Italy, no. 24934 MZUF; Paratype 1: collected on May 2010, 42.0 mm, Author's research collection no. 1722; Paratypes 2 and 3: collected on August 2010, by

Figure 3. *Oliva hirasei ameliae*, new subspecies. Holotype, 41.2 mm, Pangandaran Bay, S.W. Java, Indonesia.

local fisherman, 5-10 m, 40.3 mm and 43.6 mm, A.'s res. coll. nos. 1938 and 1939; Paratype 4: collected in 2009, 44.0 mm, A.'s res. coll. no. 2608; Paratype 5: collected on September 2009, by local fisherman, 3-5 m, 37.3 mm, A.'s res. coll. no. 1907; Paratype 6: collected on January 2011, by local fisherman, 15-20 m, 38.2 mm, A.'s res. coll. no. 2770; Paratype 7: collected in 2014, 39.2 mm, A.'s res. coll. no. 2881; Paratypes 8 to 13 and 15: collected in 2014, 2-3 m, 41.2 mm, 39.9 mm, 38.7 mm, 36.9 mm, 37.9 mm, 32.5 mm and 41.5 mm, A.'s res. coll. nos. 2888 to 2893 and 2895; Specimen 1: collected in 2014, 2-3 m, 41.0 mm, Giovanni Confortini's coll., Firenze, Italy; Specimen 2: collected on September 2009, by local fisherman, 3-5 m, 45.6 mm, Cesare Brizio's coll., Poggio Renatico, Ferrara, Italy.

Type locality: Pangandaran Bay, S.W. Java, Indonesia.

***Distribution*:** Restricted to the type locality.

***Bathymetric range*:** Shallow water, between 2 and 20 m.

***Etymology*:** It would not be fair to dedicate a mere subspecies to a scholar. In addition, too many people were involved in the gathering of the type material. Therefore, I humbly dedicate the new subspecies to my niece, Amelia Strano. I hope that, in due time, the dedication might inspire her to study the genus *Oliva*. The new name is not a homonym of *Oliva amelia* Duclos, 1845, which is a fossil *Olivella* Swainson, 1831, and, as such, it does not belong in the family *Olividae* Latreille, 1825, but in the family *Olivellidae* Troschel, 1869 [see Duclos, 1844-1845, pl. 36, figs. 1-2].

DISCUSSION

At first sight, *O. hirasei ameliae*, new subspecies, resembles *O. hirasei hirasei* Kuroda & Habe, 1952, and rarely *O. pacifica* Marrat, 1870. The morphometric analysis suggests that *O. h. ameliae* and *O. h. hirasei* are similar, the first being a less developed morph of the second **(Table 1)**. In particular, the distal (from top of protoconch to anterior end of lip) and ab-axial (maximum width) growth factors are $Lk = 1.258 \pm 0.020$ and $Lw = 1.886 \pm 0.065$ for *O. h. ameliae*, and $Lk = 1.223 \pm 0.036$ and $Lw = 1.970 \pm 0.106$ for *O. h. hirasei*. The plot graph of these factors reveals that *O. h. ameliae*, does not escape the continuum of *O. h. hirasei*. Nevertheless, being more slender, it occupies a marginal area of the continuum, a fact which justifies the sub-specific status. To emphasize the significance of the data, the graph includes *O. pacifica*, whose growth factors are $Lk = 1.243 \pm 0.023$ and $Lw = 1.609 \pm 0.065$ (***Figure 5***).

The primary morphological character which separates the two subspecies is the color of the aperture. Adults and sub-adults of *O. h. hirasei* always display an off white aperture, which may occasionally present a bluish hue. Adults of *O. h. ameliae* always display a bright purple aperture, which is paler in the sub-adults. The purple tint is not uniformly distributed from the lip to the throat, as in *O. pacifica*, but restricted to a longitudinal band, as in *O. coerulea* (Röding, 1798) and in *O. emeliodina* Duclos, 1845. Differently from those two, the tint of the aperture slightly affects the siphon notch of *O. h. ameliae*.

There are other morphological differences. The shells of *O. h. ameliae* display a light-colored lip and an ivory body-whorl background. They usually lack the yellow, orange or tan glaze of *O. h. hirasei*. For such a reason, in dorsal view, *O. h. ameliae* may look similar to small specimens of *O. pacifica*. Finally, the anterior half of the post-fasciole band of *O. h. ameliae* displays a few brown strokes instead of the dense brown strokes of *O. h. hirasei* (***Figure 6***).

Up to the present, *O. h. ameliae* is only found in the Pangandaran Bay, S.W. Java, Indonesia. This locality is outside the acknowledged distribution range of *O. h. hirasei*. The distinct geographic isolation of this Indonesian olive supports its description as a new subspecies.

ACKNOWLEDGEMENTS AND APOLOGIES

I would like to thank Karen Giacobassi for her very kind revision of the English text. I am grateful to Cesare Brizio and Giovanni Confortini for their comments upon the first draft of the article. I owe special thanks to Sandra Lucore, Naomi Ogawa and Reiko Tsubaki for their invaluable assistance in translating Hirase's and Kira's Japanese texts.

Regrettably, for the sake of brevity, I cannot explain here the theory and practice of the distal and ab-axial growth factors. As such factors appear useful to the study of Olives and, in prospects, of other shell genera, I will soon dedicate another article to this topic.

REFERENCES

Burch, J.Q. & R.L. Burch. 1959. *Olividae*, Minutes of the Conchological Club of Southern California, 192:2-13

Burch, J.Q. & R.L. Burch. 1960. *Catalogue of Recent and Fossil Olives*, Minutes of the Conchological Club of Southern California, 196:1-46

Burch, J.Q. & R.L. Burch. 1967. *The Family Olividae*, Pacific Science, 21: 503-522

Clench, W.J. 1948. *The Hirase Collection of Mollusks*, The Nautilus, 62(1):34-35

Duclos, P.L. 1844-1845. *Oliva*, in J.C. Chenu, 1844-1848, *Illustrations Conchyliologiques, ou description et figures de toutes les coquilles connues, vivants et fossiles*, Paris, Fortin, 2 vols.; vol. 1, pls. 1-15 (1844), pls. 16-36 (1845)

Hirase, Y.,1909. *On Japanese Marine Mollusca (XXV)*, The Conchological Magazine, 3-2: 13-15, 41-46

Hunon, C., A. Hoarau & A. Robin. 2009. *Olividae (Mollusca, Gastropoda): Revue Exhaustive des Espèces Récentes du Genre 'Oliva' - A Complete Survey of Recent Species of the Genus 'Oliva'*, Hackenheim, ConchBooks

Kira T., 1954 (1st ed.) and T. Kira. 1959 (2nd ed.). *Coloured Illustrations of the Shells of Japan*, Osaka, Hoikusha Publishing

Kuroda, T. & T. Habe. 1952. *Check List and Bibliography of the Recent Marine Mollusca of Japan*, Tokyo, L.W. Stach

Petuch, E.J. & D.M. Sargent. 1986. *Atlas of the Living Olive Shells of the World*, Charlottesville (Virginia), The Coastal Education & Research Foundation (CERF)

Rüdiger, B. & R.E. Petit. 1990. *On the Various Editions of Tetsuaki Kira's 'Coloured Illustrations of the Shells of Japan' and 'Shells of the Western Pacific in Color Vol. I', with an Annotated List of New Names Introduced*, Malacologia, 31(1):131-145

Sterba, G.H. 2003. *Olividae: Fiebel der Schalen*, Kiel, Sterba; English translation: 2004, *Olividae: A Collectors Guide*, Hackenheim, ConchBooks

Tursch, B. & D. Greifeneder. 1996. "*The* 'Oliva miniacea *complex', with the description of a familiar, unnamed species (Studies on Olividae, 25)*", Apex, 11(1):1-49

Tursch, B. & D. Greifeneder. 2001. *Oliva Shells. The genus 'Oliva' and the Species problem*, Recanati (Italy), Tecnostampa

Zeigler, R.F. & H.C. Porreca. 1969. *Olive Shells of the World*, Rochester (N.Y), Rochester Polychrome Press Inc.

	NW	TW	W/H (%)	*Lk*	*Lw*	Plicae (means)
O. h. hirasei	ca. 3.8	4.87 ± 0.17	44.59 ± 1.79	1.223 ± 0.036	1.970 ± 0.106	7.2/3.5/3.1/15.5
O. h. ameliae	ca. 3.7	4.54 ± 0.21	44.12 ± 0.96	1.258 ± 0.020	1.886 0.065	6.7/4.0/2.8/13.9
O. pacifica	ca. 4.3	5.49 ± 0.37	40.20 ± 1.82	1.243 ± 0.023	1.609 ± 0.065	5.2/2.9/1.8/10.8

Table 1. Data comparison between of *O. hirasei hirasei* Kuroda & Habe, 1952, *O. hirasei ameliae*, new subspecies, and *O. pacifica* Marrat, 1870 (NW = Nuclear whorls; TW = Teleoconch whorls; W/H = Width/High ratio; *Lk* = Distal growth factor; *Lw* = Ab-axial growth factor).

ISSN 0738-9388

Figure 2. *Oliva hirasei hirasei* Kuroda & Habe, 1952. Specimens from: **a.** Yonaguni Is, Japan; **b.** and **c.** Kaohsiung, Taiwan; **d.** Nha Thrang, Vietnam; **e.** Siasi Is., Philippines; **f.** Tara Is., Coron, Mimaro, Philippines; **g.** Marinduque, Mimaro, Philippines; **h.** Zamboanga, Philippines; **i.** N'Do Reef, Nouméa, New Caledonia.

ISSN 0738-9388

Figure 4. *Oliva hirasei ameliae*, new subspecies. Paratypes 1-13, from 32.5 mm to 44.0 mm, and additional specimens 1 and 2, 41.0 mm and 45.6 mm; Pangandaran Bay, S.W. Java, Indonesia.

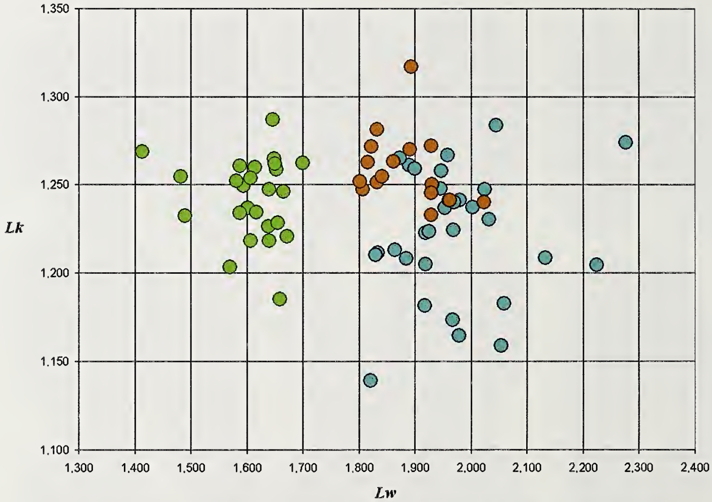


Figure 5. Plot graph of the growth factors *Lw* and *Lk* for *Oliva hirasei hirasei* Kuroda & Habe, 1952 (blue dots), *Oliva hirasei ameliae*, new subspecies (orange dots), and *Oliva pacifica* Marrat, 1870 (green dots).

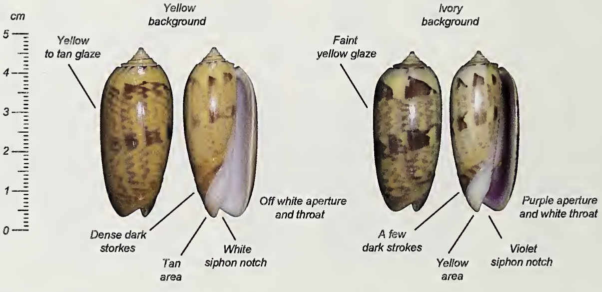


Figure 6. Morphological comparison between *O. hirasei hirasei* Kuroda & Habe, 1952, specimen from Zamboanga, Philippines, and *O. hirasei ameliae*, new subspecies, from Pangandaran Bay, S.W. Java, Indonesia.

ISSN 0738-9388

Pteropurpura festiva (Hinds, 1844) in Monterey Bay

Roger N. Clark[1] Research Associate,
Santa Barbara Museum of Natural History
[1] 3808 Pinehurst Dr., Eagle Mountain, Utah 84005
insignis_one@yahoo.com

McLean, 1978 records Santa Barbara, California as the northern extent of the range of *Pteropurpura festiva* (Hinds, 1844). Lonhart and Tupen, 2001 extended the range 112 km north to Moro Bay, based on several museum records. On May 7, 2011 while diving at 12 m, along the USCG breakwater at Monterey, California, a beautiful young specimen of *P. festiva* was found (Figure 1). The specimen was collected and is deposited at the Santa Barbara Museum of Natural History (SBMNH 235771), the specimen measures 28.21 mm in length. The specimen was found in association with specimens of the related *Pteropurpura macroptera* (Deshayes, 1839). On April 8, 2015, a second specimen was photographed (Figure 2) at 8 m, at the same site, the specimen was estimated to be about 3 cm in length. These records extend the range of *P. festiva* about 320 km to the north. No dives were made at the site between May 2011 and April 2015.

REFERENCES

McLean, J. H. 1978. *Marine Shells of southern California*. Natural History Museum, Los Angeles County, 104 pp.

Lonhart, S. I. & J.W. Tupen. 2001. *New Range Records of 12 Marine Invertebrates: The Role of El Niño and Other Mechanisms in Southern and Central California*. Bulletin of the Southern California Academy of Science 100(3):238-248.

Figure 1. *Pteropurpura festiva*. USCG Breakwater, Monterey Bay, California, 12 m. May 7, 2011.

Figure 2. *Pteropurpura festiva*. USCG Breakwater, Monterey Bay, California, 8 m. April 8, 2015.

ISSN 0738-9388

A Review of the *Haliotis rugosa* Lamarck, 1822, Complex of the Western Indian Ocean, with Notes on the Subspecific Status of *Haliotis multiperforata* Reeve, 1846

Buzz Owen[1] & Aaron D. Pan[2]

[1] P.O. Box 601, Gualala, CA 95445, buzabman@mcn.org
[2] Don Harrington Discovery Center, 1200 Streit Drive, Amarillo, TX 79106, apan@dhdc.org

ABSTRACT The three taxa *Haliotis rugosa rugosa* Lamarck, 1822, *Haliotis rugosa pustulata* Reeve, 1846, and *H. rugosa rodriguensis* Owen, 2013, are reviewed and illustrated. The confusing taxon *Haliotis multiperforata* Reeve, 1846, recently discovered to be from eastern Yemen, is validated as a fourth subspecies and is illustrated. Possible explanations for the restricted distribution of this subspecies are also explored. A map of the distribution of these taxa is included.

INTRODUCTION

The abalones (Haliotidae) are a family of marine vetigastropod gastropods that include 55 extant species (Geiger & Owen 2012; Owen 2014). Most species are endemic taxa restricted to narrow geographic areas. Some species have extensive distributions with little phenotypic variation amongst individuals (*i.e.*, *Haliotis asinina*). However, some widespread species have a tendency to form isolated subpopulations, representing multiple subspecies, within the larger context of the species. In the Western Indian Ocean *Haliotis rugosa* represents the latter, and consists of three subspecies: *H. rugosa pustulata*, distributed from the Red Sea, along the eastern coast of Africa, and extending to Madagascar, *H. rugosa rugosa* in coastal areas of Mauritius and Réunion, excluding the island of Rodrigues, where another subspecies, *H. rugosa rodriguensis*, occurs (Owen 2013). Here we recognize a new subspecies of *Haliotis rugosa* which is restricted in distribution to the Yemeni Coast in the northern Gulf of Aden. In addition, this new subspecies finally provides a concrete identification and distribution of the taxon, *Haliotis multiperforata*, described in Reeve (1846).

Abbreviations of Collections: BOC: Buzz Owen Collection, Gualala, California, USA; FFC: Franck Frydman Collection, Paris, France; HDC: Henk Dekker Collection, Winkel, The Netherlands; NGC: Norbert Göbl Collection, Gerasdorf near Vienna, Austria; NHMUK: Natural History Museum United Kingdom, London, UK; RKC: Robert Kershaw Collection, Narooma, New South Wales, Australia; SBMNH: Santa Barbara Museum of Natural History, Santa Barbara, California, USA.

Shells examined: *H. rugosa multiperforata* n. ssp. (Figure 1), Broom, Mukalla, to Jabut, Nishtun, Yemen, NHMUK 1950.3.16.32 (Lectotype; Figure 5.A), NHMUK 1950.3.16. 33-34 (Paralectotypes; Figures 5.B-C); 26; *H. rugosa rugosa* (Figure 2), Mauritius and Réunion, >200; *H. rugosa pustulata* (Figure 3), Red Sea to Mozambique, including Madagascar, >200; Tobruk, Libya, 1; *H. rugosa rodriguensis* (Figure 4), various locations, Rodrigues Island, 15.

Genus *Haliotis* Linnaeus, 1758

Type species. *Haliotis asinina* Linnaeus, 1758 (subsequent designation Montfort, 1810)

***Haliotis rugosa multiperforata* (Reeve, 1846) ssp. nov.**

Type material (as *H. multiperforata* Reeve, 1846): Lectotype: NHMUK 1950.3.16.32 (Figure 5.A), 63 mm. Paralectotypes: NHMUK 1950. 3.16 33-34 (Figure 5.B-C). 35.2 mm, 41.2 mm. Additional non-type specimens as *H. rugosa multiperforata* collected at Broom, Mukalla, Yemen, in 2005 (Figure 1), and Jabut, Nishtun, Yemen, in 2000 (Figure 5.D).

Type locality: *H. multiperforata* Reeve, 1846, Habitat unknown. **Locality** (other): *H. rugosa multiperforata* Reeve, 1846. Near Broom, Yemen, 14⁰ 18'30"N, 48⁰ 57'40"E; Nishtun, Yemen, 15⁰49'14"N, 52⁰11'49"E.

Distribution and habitat: The subspecies is distributed along Yemen's Hadhramaut and Al Mahrah coasts between Beer Ali and just north and east of Ras Fartak. Specimens taken on encrusted rocks and crevices in 0.5-5 m mostly, by snorkeling. Animals were preserved but not studied for epipodial or radulae morphology.

Description (diagnostic characters underlined): Shell small to medium (to ~63 mm), medium-weight, oblong, hardly arched, somewhat convex. Anterior margin straight to slightly curved. Spire somewhat elevated and tilted, located approximately 70% towards posterior margin of shell; partially visible in ventral view (Figure 1, top row). Holes fairly small, only slightly elevated, round, usually 7-8 open, rarely 6 or 9. Dorsal surface smooth, spiral ribbing weak to absent – when present usually very narrow, with an occasional broader thread. Spiral ribs with bumps not present on early portion of shell. Periphery between row of holes and columella smooth or with 4-5 extremely weak narrow threads closest to holes. Columella medium width to narrow. Color medium to dark brown often marked with greenish to yellow-white prosocline rays and random patches of same color. No reddish colored specimens observed which are commonly seen in the other three subspecies. Ventral surface highly iridescent silver nacre with reflections of green, pink, and steel blue. Usually very smooth with no visible ribbing present. No muscle scar.

Description of other *H. rugosa* subspecies:

***Haliotis rugosa rugosa* (diagnostic characters underlined):** (Endemic to Mauritius and Réunion). Shell small (to ~58 mm), oblong, depressed, light to medium weight, hardly arched, somewhat convex. Anterior margin straight to slightly curved. Spire low to somewhat elevated, visible in ventral view (Figure 2, top row), located approximately 70% towards posterior margin. Holes slightly larger than average, round, slightly raised, usually 5-6 open. Dorsal surface with very distinct and often deeply cut, square-profile spiral cords differing in width up to three-fold, cords often more pronounced and tightly spaced close to suture, with irregular radial growth marks. Spiral ribs with bumps often present on early portion of shell. Periphery between row of holes and columella with 2-3 very strong thick cords, occasionally with 1-2 weak threads immediately below holes. Central cord usually largest, often expanding to create a slight shelf-like ridge. Columella wide. Coloration variable; often brown to reddish-brown with fairly large areas of white, green and occasionally purple and red. Weak prosocline rays visible on some specimens. Interior usually with strong wide ribbing pattern showing through from dorsum. Nacre bright silver-white. No muscle scar. Shells from Mauritius (Figure 2.1-12) often have deeper cut, more pronounced cords than those from Réunion (Figure 2.13-15).

H. rugosa pustulata **(diagnostic characters underlined):** (Distributed from Red Sea down east coast of Africa, including Madagascar, to Park Rynie, South Africa. Very rarely migrates into the Mediterranean Sea, though most accounts may be spurious [F. Crocetta, pers. comm.]. May occur in Socotra and extend east into Oman and Muscat, but confirmation awaits positive identification of material collected from these areas [Bosch, *et al.*, 1995]). Shell small (to ~56 mm), oblong, depressed, light to medium weight, hardly arched, somewhat convex. Anterior margin straight to slightly curved. Spire low to somewhat elevated, visible in ventral view (Figure 3, top row), located more towards center of shell (~60% towards posterior margin). Holes slightly larger than average, round, slightly raised, usually 5-6 open. Dorsal surface usually with spiral cords differing in width up to three fold (in a few specimens cords are hardly visible), cords often being more pronounced and tighter spaced close to suture, may bear regularly spaced pustules; pustules may be lined up radially to form prosocline radial folds. Periphery between row of holes and columella with 2-3 rather prominent cords, occasionally with 1-2 weak threads immediately below holes. Central cord often largest, sometimes expanding to create a slight shelf-like ridge. Columella medium width. Coloration variable; most frequently sepia to dark olive base color with sharp transitions to sand and creamy blotchy markings with superimposed tenting and fine spiral mottling. Other known colors include orange, red, rust, grass green, dark cyan. Entire shell usually of same coloration; occasionally changing during ontogeny. Color pattern also has fine tenting only, watercolor transitions, no pattern. Weak prosocline rays seen on some specimens. Interior often irregular with protuberances and cording showing through from dorsum. Nacre bright white. No muscle scar.

H. rugosa rodriguensis **(diagnostic characters underlined):** (Endemic to Rodrigues Island). Shell small (to ~50 mm), fairly light-weight, oblong, hardly arched, somewhat convex. Anterior margin straight to slightly curved. Spire somewhat elevated and tilted, located approximately 70% towards the posterior margin of shell; partially visible in ventral view (Figure 4, top row). Holes medium large, fairly elevated, somewhat elongate, usually 5-6 open. Dorsal surface usually with strong bumpy spiral cords alternating with narrower ribs crossing deep, prominent lamellae-like folded ridges, giving shells very jagged irregular sculpture (ribs may appear slightly scaly on some specimens). Periphery between row of holes and columella with 2-3 very strong thick cords, occasionally with 1-2 weak threads immediately below holes. Central cord usually largest, often expanding to create a wide shelf-like ridge. Columella quite narrow. Shell very brightly colored with lime green, bright white, and purple-maroon brown; occasional specimens bright red or yellow. Colors arranged as irregular banding or patches. No prosocline rays. Ventral surface highly iridescent silver nacre with reflections of steel blue, pink, and green; usually highly irregular due to very jagged sculpture on dorsum. No muscle scar.

Comparison of *H. rugosa multiperforata* to other *H. rugosa* subspecies:

Haliotis rugosa rugosa (Figure 2) has wide and often deep spiral cords, sometimes interspaced with narrow ribbing which is often deep, flat, and has a squarish profile. The columella is wide. The periphery between the row of holes and columella has a strong major cord and several narrower ribs. The colors are widely variable and often include white, red, maroon, and green. There are usually 5-6 open holes. The ventral surface is marked with smooth but

ISSN 0738-9388

strong parallel ribs that normally show weakly developed irregular bumps or folded ridges.

Haliotis rugosa pustulata (Figure 3) often has spiral cords, which frequently may bear regularly spaced pustules which are often lined up radially to form prosocline radial folds. The periphery between the row of holes and columella has a strong major cord and several narrower ribs. The colors are widely variable and often include orange, red, and green. There are usually 5-6 open holes. The ventral surface is usually irregular with bumps, folded ridges and parallel ribs visible from dorsal surface.

H. rugosa rodriguensis (Figure 4) has strong bumpy spiral cords alternating with narrower ribs crossing deep, prominent lamellae-like folded ridges, giving shells very jagged irregular sculpture. Most specimens have spiral ribs with bumps present on early spire. The periphery between the row of holes and columella has a strong major cord and several narrower ribs. The colors are widely variable and often include white, red, green, and yellow. There are usually 5-6 open holes. The ventral surface is extremely irregular due to very jagged sculpture on dorsum.

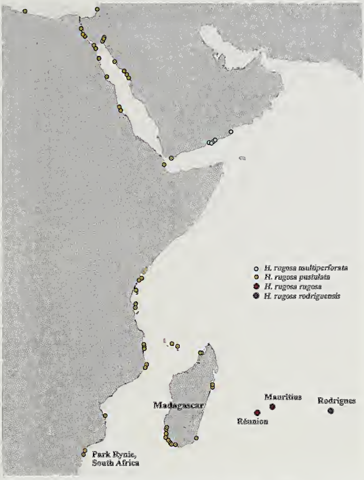


Figure 7. Map showing distribution of the four *H. rugosa* subspecies.

DISCUSSION / REMARKS

The distribution of *Haliotis rugosa multiperforata* is relatively unusual, being located within a very restricted area along the continental coastline, as opposed to an isolated island (or island group) like the majority of *Haliotis* subspecies. The subspecies' location in the northern portion of the Gulf of Aden along Yemen's Hadhramaut and Al Mahrah coasts, lies within an area that is not as greatly affected by the Somali Current as other portions of the southern coastline of the Arabian Peninsula further east (Schott & McCreary 2001; Al Saafani 2008; Ali, *et al.* 2009). Part of this may be attributed to the presence of the anticyclonic Socotra Gyre and 'Great Whirl', which direct waters during the summer months along the southern coast of the Horn of Africa, eastward past Socotra towards the coast of Oman, diverting currents from the Yemeni Coast. These strong eddies may prevent the mixture of *Haliotis rugosa pustulata* populations along the East Coast of Africa with *H. rugosa multiperforata*. This portion of the northwestern Gulf of Aden is also generally isolated from the Red Sea by the narrow strait of Bab-el Mandeb. In addition, the study on reproductive biology of this subspecies, considered *H. pustulata* at the time (Ali, *et al.* 2009), noted that the majority of gravid individuals spawn between March and

April. Interestingly, this time period coincides with shallow Ekman drifts, within the western Gulf of Aden, flowing towards the Yemeni Coast (Al Saafani 2008). The co-occurrence of the synchronized spawning with the onshore Ekman Drifts may provide a mechanism that prevents dispersal of this subspecies from expanding to the Omani coast further east. However, more studies need to be done on the reproductive biology of *H. rugosa pustulata* along the East African coast and the Red Sea to determine if spawning times are similar to those of *H. rugosa multiperforata*, or if differences in spawning times may maintain the Yemeni subspecies.

ACKNOWLEDGEMENTS

We thank Atalla Ali for providing the specimens and information that made this study possible. We also thank David Berschauer and Dr. Edward Petuch for editorial guidance in writing the manuscript, Robert Kershaw for providing many of the images used on Figures 2 and 3, and Arjay Raffety for providing insight in review of the figures.

REFERENCES

Ali. A. M., A. A. Basmidi, M. Sh. Aideed, & Al-Quffail A. Saeed. 2009. First Remarks on Abalone Biology (*Haliotis pustulata*) on the Northern Coast of Aden Gulf, Yemen. *Journal of Fisheries and Aquatic Science*, 4: 210-227.

Al Saafani, M.A. 2008. Physical Oceanography of the Gulf of Aden. Doctoral Dissertation, Goa University, Goa, India. 213 pp.

Bosch, D. T., S. P. Dance, R. H. Moolenbeek, & P. G. Oliver. 1995. Seashells of Eastern Arabia. *Motivate Publishing,* Abu Dhabi, UAE. 296 pp.

Geiger, D. L. 1998. Recent Genera and Species of the Family Haliotidae Rafinesque, 1815 Gastropoda: Vetigastropoda). *The Nautilus* 111:85-116.

Geiger, D. L. 2000. Distribution and Biogeography of the Recent Haliotidae (Gastropoda:Vetigastropoda) World Wide. *Bollettino Malacologico* 35:57-120.

Geiger, D. L. & B. Owen. 2012. Abalone Worldwide Haliotidae. *Conchbooks*, Hackenheim, 361 pp., 92 pls.

Lamarck, J. B. 1822. Natural History of the Animals Without Vertebrae. Vol. 6(2):1-232.

Owen, B. 2013. Notes on the correct taxonomic status of *Haliotis rugosa* Lamarck, 1822, and *Haliotis pustulata* Reeve, 1846, with description of a new subspecies from Rodrigues Island, Mascarene Islands, Indian Ocean (Mollusca: Vetigastropoda: Haliotidae). *Zootaxa* 3646: 189-193.

Owen, B. 2014. A new species of *Haliotis* (Gastropoda) from São Tomé & Príncipe Islands, Gulf of Guinea, with comparisons to other *Haliotis* found in the Eastern Atlantic and Mediterranean. *Zootaxa* 3838:113-119.

Reeve, L. 1846. A Monograph of the Genus *Haliotis*. *L. Reeve & Co.* London, 24 pp., 17 pls.

Schott, F.A. & J. P. McCreary Jr. 2001. The monsoon circulation of the Indian Ocean. *Progress in Oceanography* 51:1-123.

ISSN 0738-9388

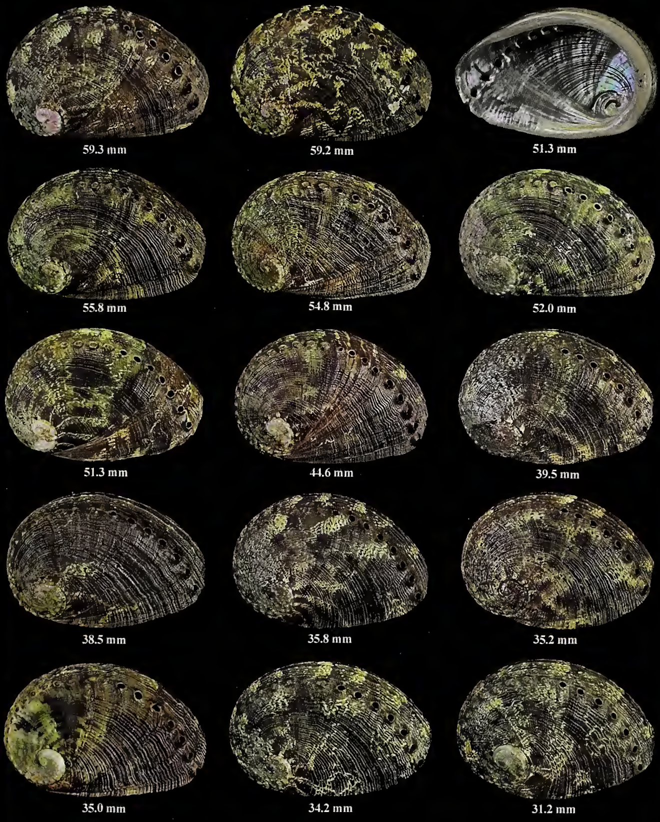


FIGURE 1. ***Haliotis rugosa multiperforata*** **(Reeve, 1846) n. ssp. Broom, 35 km SW of Mukalla, Yemen. Live-taken snorkeling 0.5-5 m. 2004-2006. All specimens in BOC.**

ISSN 0738-9388

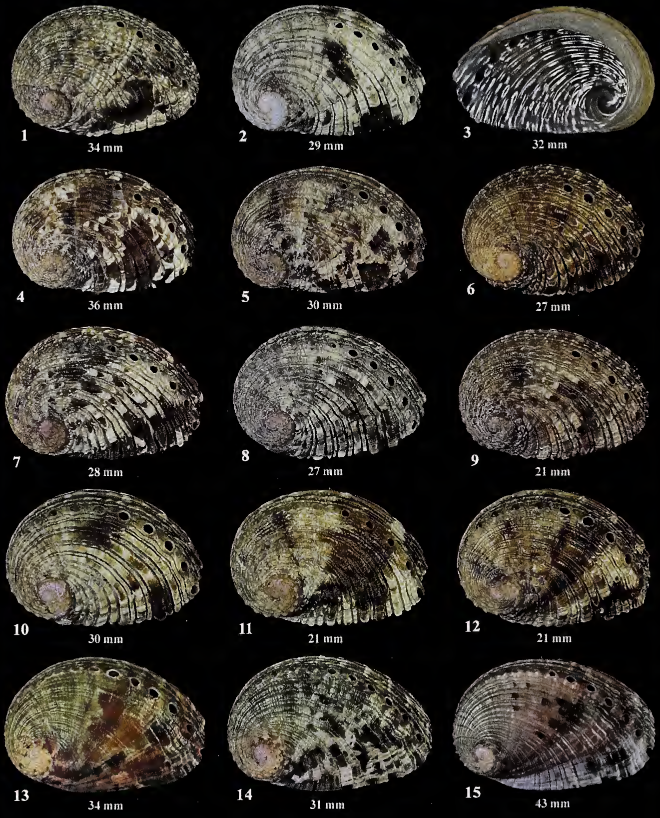


FIGURE 2. *Haliotis rugosa rugosa* Lamarck, 1822. Numbers 1-12 from Mauritius; 13-15 from Réunion. 5-10 m. All live-taken. All specimens in RKC.

ISSN 0738-9388

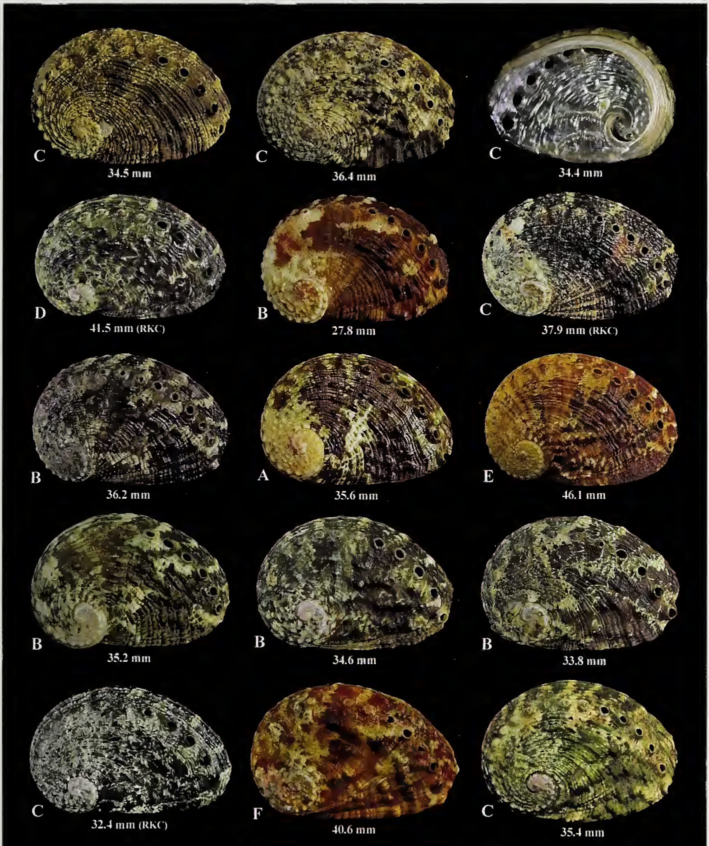


FIGURE 3. *Haliotis rugosa pustulata.* A - Tobruk, Libya. B - Tulear, Madagascar. C - Fernão Veloso, Mozambique. D - Nuieba, Sinai. E - Northern Red Sea, Egypt. F - Park Rynie, South Africa. Only data. All BOC unless otherwise indicated.

ISSN 0738-9388

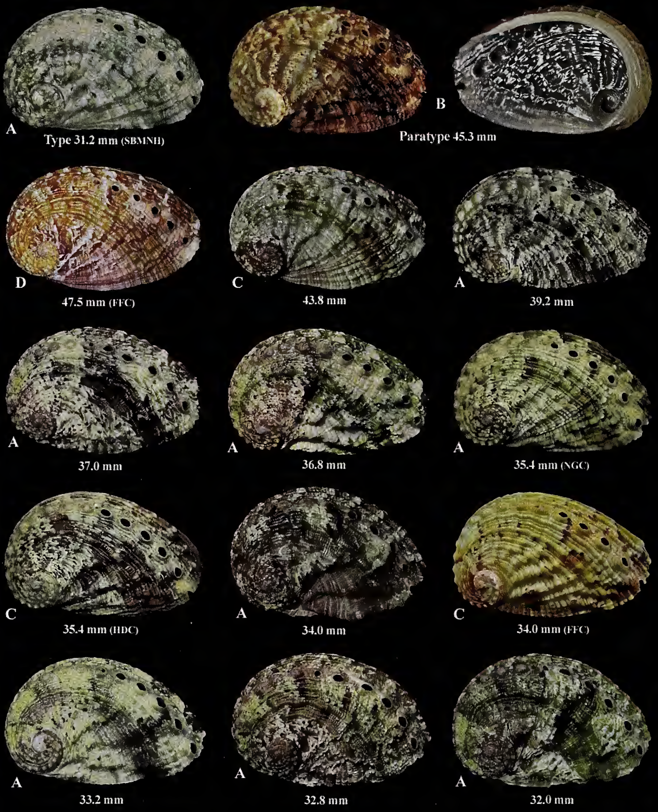


FIGURE 4. ***Haliotis rugosa rodriguensis.*** **A - Anse Cotton; B - Grande Baie; C - Saint François; D - Graviers. All Rodrigues Island. Live-taken snorkeling 3-4 m. All BOC unless otherwise indicated.**

ISSN 0738-9388

FIGURE 5. Top 2 rows: *H. multiperforata* Reeve, 1846. A-C "Syntypes" (Lectotypes). NHMUK. Hab. unk.; D - Jabut, Nishtun, Yemen. Row 3: *H. rugosa multiperforata* n. ssp. Mukalla, Yemen. BOC. Row 4: *H. rugosa rugosa*. Mauritius. BOC, Row 5: *H. rugosa pustulata*. Mozambique. BOC. Bottom row: *H. rugosa rodriguensis*. Rodrigues Is. BOC (Type SBMNH).

ISSN 0738-9388

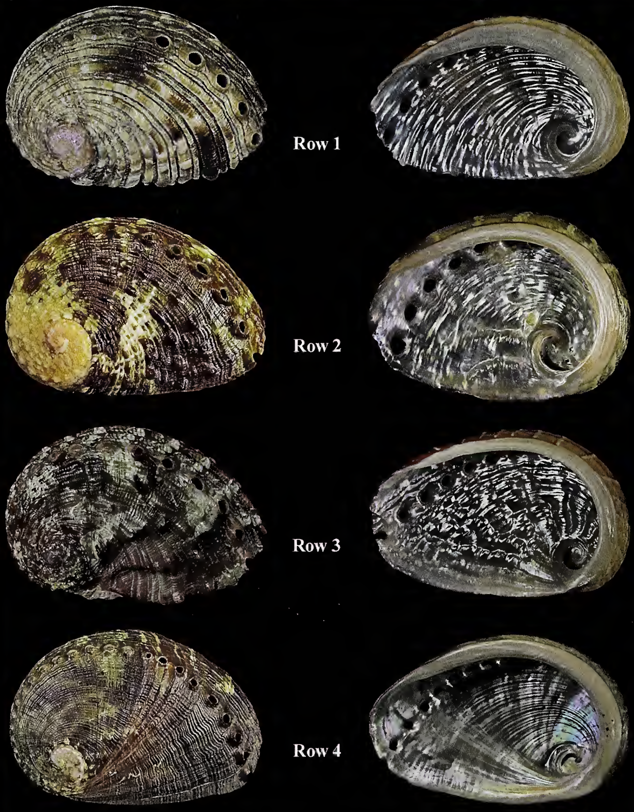


FIGURE 6. Differential Diagnosis

Row 1: *H. rugosa rugosa* Lamarck, 1822; Row 2: *H. rugosa pustulata* Reeve, 1846
Row 3: *H. rugosa rodriguensis* Owen, 2013; Row 4: *H. rugosa multiperforata* (Reeve, 1846) n. ssp.

ISSN 0738-9388

Mutant Sinistrality in the Polygyridae; an Update

Harry G. Lee
4132 Ortega Forest Drive, Jacksonville, FL 32210-5813
shells@hglee.com

The terrestrial pulmonate family Polygyridae is the most speciose and widespread such group in North America, occurring in 45 of the 49 continental states of the USA, stretching into Canada and Mexico and straggling into the outskirts of Central America and the West Indies. Thus defined, the family conforms with remarkable precision to the political boundaries of North America as any natural lineage of organisms ever has -- and from the late Cretaceous Period (Pilsbry, 1940).

The metropolis of the family is east of the American Rockies, where 18 (15 endemic) of its two dozen genera occur (Schileyko, 2006), generally prospering in humid deciduous forests. These 140-odd species constitute over one quarter of the eastern US landsnails (Hubricht,

1

Figure 1. *Neohelix albolabris* (Say, 1817)

1985). Because of their size (adults 5-45 mm; median ~15 mm), diversity, elaboration of the aperture, and general eye-pleasing form, polygyrids caught the fancy of collectors (*e.g.*, M. Lister *et al.*, 1685,[1] our Figure 1) well before its first 3 species were formally described by the America's founding conchologist, Thomas Say (1817).

The special attention given these snails has led to more efficient detection and better preservation of specimens, including unusual ones. Reversal of gastropod chirality has been noted for centuries in the conchological literature, and it happens to fascinate the writer. Terrestrial pulmonates, more specifically the Stylommatophora, have a much higher frequency of mutant reversal of coil than do any other snail group, and it is no surprise that the polygyrid species are prominent among this worldwide lineage. Lee (2011a) assembled records of reverse-coiled polygyrids (all from the eastern USA) for about 53 specimens of 23 species in 15 genera. Since then several more have come to light, most actually collected after the publication appeared. The following account is an attempt to update the tally and analyze the data. The new records are presented in alphabetical (genus, then species), thus, and otherwise, in conformation with the format in Lee (2011a)

(1), (2) ***Mesodon clausus* (Say, 1821)** Circleville, Pickaway Co., OH, Joseph Lewis! December, 1899, CM 82070; Antioch, Jackson Co., TN, Bob Winters! April 9, 2015, Winters Collection (Winters, 2015b); Figure 2: 17 mm

Figure 2. *Mesodon clausus* (Say, 1821) .

Figure 3. *Polygyra cereolus* (Mühlfeld, 1818)

Figure 4. *Triodopsis fallax* (Say, 1825)

ISSN 0738-9388

(3) ***Polygyra cereolus*** **(Mühlfeld, 1818)** Hastings, St. Johns Co., FL, H.G. Lee! April 23, 2006. Lee Collection (Lee, 2012); Figure **3**: 7 mm.

(4)***Triodopsis fallax*** **(Say, 1825)** Lexington, Rockbridge Co., VA, Mrs. K.C. Brooke! Oct. 15, 1901, CM 97968: Figure **4**: 13 mm.

(5) ***Triodopsis hopetonensis*** **(Shuttleworth, 1852)** Residence, Woodleaf Court, Charleston, SC, Tom Smith! 29 August, 2009, Smith Collection; ~10 mm.

4a

Figure 4a. ***Triodopsis hopetonensis*** **(Shuttleworth, 1852)**

Figure 5. ***Triodopsis juxtidens*** **(Pilsbry, 1894)**

(6), (7) ***Triodopsis juxtidens* (Pilsbry, 1894)** Stanardsville, Green Co., VA, John Slapcinsky! 1988. FMNH 279499; residence, Powell's Landing Circle, Woodbridge, Prince William County, VA, Tom Smith! 8 February, 2015, Smith Collection; Figure **5**: ~ 13mm.

(8) ***Triodopsis messana* Hubricht, 1953** Jacksonville, Duval Co., FL, Bill Frank! 16 July, 2015, Frank Collection ([Lee], 2015); Figure **6**: 13 mm.

Figure 6. *Triodopsis messana* Hubricht, 1953

Figure 7. *Triodopsis vulgata* Pilsbry, 1940

(9) ***Triodopsis vulgata* Pilsbry, 1940** Bernheim Forest, Nelson Co., KY, H.G. Lee! Lee Collection; Figure 7:15 mm.

(10) ***Triodopsis* species ["Florida Scrub Threetooth," an apparently unnamed taxon]** Camp Blanding, Clay Co., Florida. Bill Frank! 14 December, 2013, Frank Collection; Figure **8**: 15 mm.

Figure 8. *Triodopsis* species ["Florida Scrub Threetooth," an apparently unnamed taxon]

Figure 9. *Xolotrema obstrictum* (Say, 1821)

(11) ***Xolotrema obstrictum* (Say, 1821)** Drift, confluence Estill and Larkin Forks, Jackson Co., AL, Bob Winters! March 17, 2015, Winters Collection (Winters, 2015a); Figures **9**, **10**: 22 mm.

Figure 10. ***Xolotrema obstrictum*** **(Say, 1821)**

After integration of the above data with Lee (2011), the current sinistral polygyrid breakdown is: 15 genera (no change), 27 species (4 addenda), about 64 specimens (11 addenda), and twenty-five attributed collectors (with the **five new pantheon inductees**) found 47 of the approximately 64 known specimens:

Archer, A.F. **3**	Hubricht, L. **11**	Slapcinsky, J. **2** [up 1]
Baily, R.I. **1**	Lee, H.G. **3** [up 2]	**Smith, T. 2**
Binney, W.G. **1**	Lewis, J(ames). **1**	Stannage **1**
Brooke, (Mrs.) K.C. 1	**Lewis, J(oseph) 1**	Sullivan, W. **1**
Bryant, F.W. **1**	Marsh, P. (?) **2**	Thompson, F.G. **1**
Feinberg, H.S. **1**	Mehring, A.L. **1**	Webb, G.R. **1**
Fluck, W.H. **2**	Pratt, W.L. **1**	Wetherby, A.G. **3**
Frank, W. 2	Schilling, F. **1**	**Winters, B. 2**
	Singley, J.A. **1**	

Considering the above images, the fact that 15 of the 18 genera and 27 of the 140 species occurring in the eastern USA are now represented on the list, and that those 27 are among the more familiar, widespread, and frequently represented in collections, I think it quite reasonable to make the following generalizations with regard to mutant sinistral coil in the Polygyridae:

- phenomenon is quite thinly, but evenly spread over a broad phylogenetic and zoogeographic span within the family; and
- its occurrence correlates rather well with number of specimens made available for study.

Thus it's not so much the species selected than the number of individuals examined that will foster success in this game against long odds, and, with such limited prospects:

- the successful player holds the hand he's dealt. In this game, restrain ambitions and be happy with less, often a lot less, than

"gem" quality. These shells don't last forever in nature.

[1] *Cochlea virginiana* of the Listers (Martin and artist daughters Anna and Susanna) is almost certainly a synonym of *Helix albolabris*, now *Neohelix albolabris* (Say, 1817). The polymath Englishman Dr. Martin Lister (1639-1712), physician to Queen Anne, was in correspondence with Rev. John Banister (ca.1650-1692), an English colonist who was Oxford-educated in natural science. Aside from ministering to an Anglican parish, he collected plants and shells in tidewater Virginia and was a founder of the College of William and Mary, located near his Charles City home. Banister is known to have sent the regal doctor field-collected material (Ewan and Ewan, 1970: xxi, *passim*).

Abbreviations employed:
CM: Carnegie Museum of Natural History, Pittsburgh, PA
FMNH: Field Museum of Natural History, Chicago, IL

ACKNOWLEDGMENTS:

Along with the collectors acknowledged above, I owe thanks to Dr. Tim Pearce, CM (Figures 2, 4, 9), Bob Winters, Sparta, TN (Figure 10), Tom Smith, Woodbridge, VA (Figures 4a, 5), and Bill Frank, Jacksonville, FL (Figures 3, 6, 7, 8) for the photographs used here. Mr. Frank also did most of the image editing.

REFERENCES:

Ewan, J. and N. Ewan, 1970. *John Banister and his Natural History of Virginia.* University of Illinois, Urbana. xxx + [1]-485 + [i] incl. 32 pls.

Hubricht, L., 1985. The distribution of the native land mollusks of the eastern United States. *Fieldiana: Zoology* 24:1-91. http://www.biodiversitylibrary.org/item/21394#page/5/mode/1up

Lee, H.G., "2010" [2011a]. Gettleman key to probe of major reversals. *American Conchologist 38*(4):6-11. "December" [January].

Lee, H.G., 2011b. Historical notes on a sinistral sacred chank: *Turbinella pyrum. American Conchologist 39*(2):28-29. June [July].

Lee, H.G., 2012. Sinistral peanut snail and polygyrid update. Sequestered specimens, oversight, irony, and a failed strategy with a happy outcome. *American Conchologist 40*(2): 4-6. June.

[Lee, H.G.], 2015. The first known sinistral specimen of *Triodopsis messana* Hubricht, 1952. *Shell-O-Gram 56*(4):2. July. http://www.jaxshells.org/pdfs/julaug15.pdf [a complete set of this journal from Nov., 1998 to present is posted at http://jaxshells.org/letters.htm]

Lister, M., S. Lister, and A. Lister, 1685. *Historia sive synopsis methodicae conchyliorum quorum omnium picturae vivum delineatae tur. Liber primus, qui est de cochleis terrestribus.* Published privately, London. [1-6] + pls. [1--42; incl. figs. 1-104] + tab. [1-4 http://gdz.sub.uni-goettingen.de/dms/load/img/?PPN=PPN470143703&DMDID=DMDLOG_0001&LOGID=LOG_0001&PHYSID=PHYS_0001]. [Three volumes [libri; = books] followed: 1686, 1687-8, 1688-1697 to complete the masterwork; see Wilkins, 1957]

Pilsbry, H.A., 1940. *Land Mollusca of North America (north of Mexico) vol. 1 part 2.* Academy of Natural Sciences, Philadelphia. vi + 575-994 + ix. 1 Aug. http://babel.hathitrust.org/cgi/pt?id=uc1.31822000620245;view=1up;seq=7

Say, T., 1817. "Conchology" *in* Nicholson,W., [*First*] *American edition of the British encyclopedia and dictionary of arts and sciences comprising an accurate and popular view of the present improved state of human knowledge. Volume 2* [of 6]. Mitchell, Ames and White, Philadelphia. [1-15] + plates 1-4.

Schileyko, A.A., 2006. Treatise on Recent terrestrial pulmonate molluscs 13. Helicidae, Pleurodontidae, Polygyridae, Ammonitellidae, Oreohelicidae, Thysanophoridae. *Ruthenica supplement 2*:(ii) + 1765-1906. May.

Wilkins, G.L., 1957. Notes on the *Historia Conchyliorum* of Martin Lister (1638[sic]-1712). *Journal of the Society for the Bibliography of Natural History* 3(4):196-205.

Winters, B., 2015a. Left handed luck. *The Nautiloid* 2015(4):6. April. [Back issues of this journal are available up through Feb., 2015 at <https://sites.google.com/site/northalshellclub/home/newsletter>, and ensuing numbers will be added regularly.]

Winters, B., 2015b. Lotsa left-handed luck *The Nautiloid* 2015(7): 3-5. July.

APPENDIX (summary from Lee, 2011a: 10):

***Allogona profunda* (Say, 1821)** [Pilsbry, 1940: 879: Shimek and Billups have recorded 4 (no reference)] **(4)**
***Daedalochila avara* (Say, 1818)** [4132 Ortega Forest Dr., Jacksonville, FL, H.G. Lee! 27 July, 1977; Lee Collection] **(Fig. 9) (1)**
***Euchemotrema leai* (A. Binney, 1841)** [Archer, 1934: 148: Ann Arbor, MI, Alan F. Archer! 1932-1933] **(1)**
***Inflectarius inflectus* (Say, 1821)** [Bland, 1861: 448: John Gould Anthony Collection, ?MCZ; Pilsbry, 1940: 773: Hubricht! St. Louis, MO; FMNH; Feinberg, 1970: 12-13: Carter Co., TN, Harold S. Feinberg! 4 June, 1969, AMNH 57293] **(3)**
***Linisca texasiana* (Moricand, 1833)** [Hubricht, 1978: three, FMNH] **(3)**
***Mesodon clausus* (Say, 1821)** [Hubricht, 1978: immature; FMNH; Houston, TX, A.L. Mehring! 13 December, 1960. Gettleman Collection] **(2)**
***Mesodon elevatus* (Say, 1821)** [Tryon 1867: 104: Frank Daulte Collection, Cincinnati] **(1)**
***Mesodon mitchellianus* (I. Lea, 1839)** [Bland, 1861: 448: Thomas Bland Collection, ?AMNH but not in Gratacap (1901); Wetherby, 1895: 94: near Cincinnati, OH, F.W. Bryant!] **(2?)**
***Mesodon thyroidus* (Say, 1817)** [Bland, 1861: 448: Bland Collection, ?AMNH but not in Gratacap (1901); Wetherby, 1895: 94: three shells: one Cincinnati, OH, Stannage! two Wetherby! one deposited at MCZ; Archer, 1934: 148-149; two specimens, Ann Arbor MI, A.F. Archer! April, May, 1933; Petit, R.E., March, 2007, personal communication, G.R. Webb letter to P.H. Reed late Sept. or early Oct., 1946, prob. FMNH] **(8?)**
***Mesodon zaletus* (A. Binney, 1837)** [Pilsbry, 1940: 725: two specimens: one Herkimer Co, NY, one ANSP; Fluck, 1943: 105: two of several hundred individuals, Ilion, Herkimer Co., NY, W.H. Fluck!] N.B. Ilion colony introduced by James Lewis (*fide* A. Bailey, Pilsbry, 1940: 724-725), therefore derived from dextral stock. **(3-4?)**
***Millerelix mooreana* (W.G. Binney, 1857)** [Pilsbry, 1940: 624: J.A. Singley!] **(1)**
***Neohelix albolabris* (Say, 1817)** [Lewis, 1872: 99: near Mohawk, NY, James Lewis! June, 1871; Pilsbry, 1940: 838: several known; Reigle, 1962: 37; Washtenaw Co., MI, Phil Marsh(?)!; UMMZ 210163] **(prob. >6)**
***Patera roemeri* (L. Pfeiffer, 1848)** [Pratt, 1965: Possum Kingdom S.P., Palo Pinto Co., TX, W(illiam) Lloyd Pratt! (?)1965, Pratt Collection no. 992] **(1)**
***Polygyra cereolus* (Mühlfeld, 1818)** [Baily, 1942: 102: Hillsboro, FL, R.I. Baily! Spring 1940; Sullivan, 1986: Desoto Park, Manatee Co., FL, Wayne Sullivan! 1986] **(Fig. 10)] (2)**
***Polygyra septemvolva* Say, 1818** [W.G. Binney, 1878: 282 MCZ; Waccasassa River, SR 24 bridge, Levy Co., Florida, John Slapcinsky! 19 March, 2005, Lee Collection] **(Fig. 11) (2)**
***Praticolella* species** [23 km NNW El Limon, Tamaulipas, Mexico, Fred G. Thompson! 27 December, 1989, Lee Collection] **(Fig. 12) (1)**
***Stenotrema hirsutum* (Say, 1817)** [Bland, 1961: 448: Isaac Lea Collection, ?USNM] **(1)**
***Triodopsis fallax* (Say, 1825)** [Bland, 1861: 448: William Greene Binney Collection, ?AMNH but not in Gratacap (1901); Hubricht, 1978: two, FMNH] **(3)**
***Triodopsis hopetonensis* (Shuttleworth, 1852)** [Pilsbry, 1940: 812: ANSP; Hubricht, 1978, FMNH] **(2)**
***Triodopsis obsoleta* (Pilsbry, 1894)** [Hubricht, 1978: three, FMNH] **(3)**
***Triodopsis vulgata* Pilsbry, 1940** [Reigle, 1962:36-37: Washtenaw Co., MI, Phil Marsh(?)!, UMMZ 210162] **(1)**
***Webbhelix multilineatus* (Say, 1821)** [Wetherby, 1895: 94: A.G. Wetherby! MCZ] **(1)**
***Xolotrema fosteri* (F.C. Baker, 1932)** [Pilsbry, 1940: 831: W.G. Binney! 202 Union St., Burlington, NJ (his own garden), ?AMNH, but not in Gratacap (1901); St. Louis, MO, Frieda Schilling! 2 May, 1969, Lee Collection] N.B. NJ specimen definitely derived from (naturalized) dextral stock. **(Fig. 13) (2)**
Total: 15 genera, 23 species, about **(53) specimens.** Twenty attributed collectors took **36 of the approximately 64 known specimens.**

ISSN 0738-9388

Commercially Driven Taxonomy: the Necessity of "Knowing" Species

Stephen J. Maxwell[1] and Tasmin L. Rymer[2]

[1] College of Marine and Environmental Sciences, James Cook University,
P.O. Box 6811, Cairns, QLD 4870, Australia stephen.maxwell@my.jcu.edu.au

[2] College of Marine and Environmental Sciences, Centre for Tropical Environmental and Sustainability, James Cook University, P.O. Box 6811, Cairns, QLD 4870, Australia

KEY WORDS Economic incentive, Species classification, Taxonomic inflation, Species concept, Taxonomic nomenclature.

Taxonomic inflation, the raising of an organism to a different taxonomic state to exaggerate its importance, is a direct contributor to inflated estimates of endemism, often with a geopolitical bias (Issac *et al.*, 2004; Harris & Froufe, 2005). Taxonomic inflation reflects the long standing issue in the classification of nature, as higher ranks are erected and the taxonomy of intraspecific ranks is relegated in favour of newly named species. There are currently three postulated causes for taxonomic inflation: (1) the discovery of new species where, taxonomic inflation is often a reflection of the "rediscovery" of new species buried within a polytypic nature of an organism by supposedly recognizing cryptic diversity (Tattersall, 2007; Dubois, 2008); (2) the changes in the systematic approach to the classification of organisms and the author's failure to clearly identify which one of the many different "species concepts" they utilized in elevating to species status organisms which were previously accepted as forms, varieties or subspecies (Tattersall, 2007; Dubois, 2008); and (3) a consequence of academia and the need for taxonomists to publish, as highlighted by inflated species recognition by authors and unwarranted descriptions that are not justified by the evidence for divergence (Dubois, 2008; Sundberg & Stand, 2009; Bebber *et al.*, 2014). We argue for a fourth cause for taxonomic inflation. That is, the economic incentives to specimen dealers seeking to maximize marketability of organisms by elevating an organism to a different taxonomic state. Fundamentally, there needs to be a realization that, while the commercial value of species is a complex commercial issue subject to market forces, species values will increase as dealers chose to utilize new taxonomic names to create marketable opportunities. Therefore, it is important to recognize that taxonomic inflation is also a by-product of the differing functions of nomenclature depending on the needs of the user, be it the taxonomist seeking to describe nature, the dealer seeking to maximize economic profit, or the systematist concerned with the demarcation of units that are significant in evolutionary terms.

Commercial taxonomic inflation can have significant impacts on the systematist working to formulate an understanding of the evolutionary patterns of collectible organisms, such as molluscs. The primary problem arises during the revision phase, when the status of the organisms to be included within a clade is determined. Splitting existing taxa, or the elevation of clines and forms to full species (or other infraspecific ranks), is often accompanied by a failure to provide context to the species concept used to designate that organism, leading

to taxonomical confusion. The problems of taxonomic inflation, irrespective of cause, can only be mediated when there is acceptance of the need to explicitly identify the taxonomic concept being used, facilitating an explanation of the differing needs of various taxonomists that might be undertaking the classification (Agapow & Sluys, 2005; Knapp *et al.*, 2005). Explicitness in conceptual approach to the delineation of species also enables the taxonomist, attempting to moderate inflation, to evaluate the contextual relativity of the organism that is being named or reclassified. Contextual relativity reflects the real world applicability of the species concept in terms of the different needs of the various taxonomic users. Further, this necessitates a tolerance for taxonomic freedom to choose species concepts that delineate taxa to meet the diverse requirements of the users of nomenclature. The species term, without conceptual context, therefore becomes a rhetorical device used by a taxonomist, irrespective of terminological accuracy or appropriateness of use (Magnus, 1996).

Taxonomic inflation is a natural by-product of the diversity of taxonomical users, as organisms are classified in ways that reflect the needs of those who utilize taxonomic nomenclature. Commercial taxonomic inflation is a direct by-product of the increasing value of organisms on the collector market, and as the value of organisms increase, so will the market forces that implicitly drive the process of delimiting species. To enable critical evaluation of any new taxonomic entity it is imperative that the criteria for species demarcation be disclosed. This disclosure will mitigate the effects of taxonomic inflation as users are able to recognize the significance of the new species even if this comes at a cost in terms of taxonomic acceptability to some users.

REFERENCES

Agapow, P.M. and R. Sluys (2005) The reality of taxonomic change. Trends Ecol. Evol. 20: 278-280.

Bebber, D.P. *et al.* (2014) Taxonomic capacity and outer inflation. New Phytol. 202:742-742.

Dubois, A. (2008) A partial but radical solution to the problem of nomenclatural taxonomic inflation and synonymy load. Biol. J. Linn. Soc. 93:857–863.

Harris, D.F. and E. Froufe (2005) Taxonomic inflation: species concept or historical geopolitical bias? Trends Ecol. Evol. 20:6-7.

Issac, N.J.B. *et al.* (2004) Taxonomic inflation: its influence on macroecology and conservation. Trends Ecol. Evol. 19:464-469.

Knapp, S. *et al.* (2005) Taxonomic inflation, species concepts and global species lists. Trends Ecol. Evol. 20:7-8.

Magnus, D. (1996) Theory, practice, and epistemology in the development of species concepts. Stud. Hist. Phil. Sci. 27:21-545.

Sundberg, P. and M. Stand (2009) Taxonomic inflation or taxonomist deflation? A comment on Dubois. Biol. J. Linn. Soc. 96:712-714.

Tattersall, I. (2007) Madagascar's Lemurs: cryptic diversity of taxonomic inflation. Evol. Anthr. 16:12-23.

ISSN 0738-9388

Have a shell collection you would like to donate or devise?

The San Diego Shell Club is interested in high quality estate shell collections. As a 501c(3) organization all donations to our Club may provide a tax write-off. When we receive a donation we carefully record each item and provide a letter describing the items for use when filing your taxes. While we cannot provide a value, donations of up to $5,000 do not require a written appraisal. Since tax laws change regularly we recommend that you check with your tax accountant before relying on any information provided in this paragraph. We are interested in all types of shells, marine or land and all genera and species, books on shells as well as items related to shells such as artwork, storage cases and tools. Your items will be used to generate income to support the Club's efforts in continuing Public education about shells and conservation of marine life throughout the world. If you would like to donate, please contact Dave Waller, SDSC Acquisition Chairperson, at dwaller@dbwipmg.com to schedule a time to discuss charitable gifting.

CLUB NEWS

October 17, 2015: Regular Meeting, Holiday Inn Express, 751 Raintree Drive, Carlsbad, CA.

• Meeting was called to order at 12:30 p.m. Announcements were made.
• Speaker Craig Hoover, Grad Student at Cal Poly Pomona, gave talk on the genetics of Nudibranch *Felimare californiensis* populations. The talk was graded for our student research award.
• President Larry Buck announced the officer slate announced for 2016, there was a call for nominations from the floor. No other nominations were made.
• Bylaws changes were discussed and unanimously approved by vote of members present.
• Meeting adjourned at 2:22 p.m.

November 4, 2015: Regular Meeting, Holiday Inn Express, 751 Raintree Drive, Carlsbad, CA.

• Meeting was called to order at 12:00 noon.
• Following announcements the annual elections were held. There was a call for nominations from the floor. No other nominations were made. All officers on the slate of proposed officers were elected by unanimous vote of members present.

• The November shell auction was held, including a “dollar table”, “five dollar table”, “silent auction”, a book section, and the live auction. Pizza and soft drinks were provided by the Club, and other beverages made an appearance. A good time was had by all.
• Meeting adjourned at 2:45 p.m.

December 2015: No regular meeting. Holiday party held at David and Felicia Berschauer’s home.

January 15, 2016: Regular Meeting, Staybridge Suites, 2735 Palomar Airport Rd, Carlsbad, CA.

• Meeting was called to order at 12:07 p.m. Announcements were made.
• Speaker Jenny McCarthy, Masters Student at Cal Poly Pomona, gave talk on the Juliidae, shelled Sacoglossan sea slugs which have a bivalve shell with a protoconch on one valve. The talk was graded for our student research award.
• Nancy Hale brought gourmet cookies, and the Club provided beverages.
• There was a “dollar table” for books, a “five dollar table” for shells and a “silent auction” for shells. Shells were displayed from the inter-club exchange with the Cairnes Shell Club in Queensland, Australia; these shells will appear in the April Auction.
• Bill Schramm gave a brief show and tell presentation on *Voluta imperialis*.
• Meeting adjourned at 2:40 p.m.

The San Diego Shell Club Holiday Party 2015

David Waller

This year’s Holiday Party was once again hosted by the David and Felicia Berschauer. The house was beautifully decorated for the holiday season and the three little elves (Beauty, Yuki, and Tiny) where there at the door to welcome all our members with tails wagging. Santa had come early bringing gifts for the Club’s gift exchange and fabulous barbeque delivered by Elf Schramm. Everyone was treated to a sleigh ride around the Berschauer research facility created and built by David (aka Dave’s “Shell Cave”). A must see! While enjoying some tasty barbeque brisket and ribs we were captivated by the sharing of stories about diving and collecting as our members discussed their adventures around the world. These are the types of stories that create visions of sugar plums dancing in our heads. Shortly thereafter, shells began appearing for all the good boys and girls. There was a truck load of abalone, a table full of *Spondylus*, Cowries, *Murex* and Ho-Ho-Ho it was time for the gift exchange. Then as soon as it came, it was over leaving everyone a little sad but excited about what Santa will bring to the 2016 Holiday Party.

ISSN 0738-9388

Shelling on the Gulf Coast of Florida (Part 2 of 2)

Robyn Waayers
5893 Mountain Meadow Road, Julian, CA 92036
rwaayers@gmail.com

This is a continuation of Robyn Waayer's shelling adventure in January 2015.

Day Three:

On this day we planned to drive around two hours south of Englewood to Marco Island, and then explore the Big Cypress National Preserve (with birding, not shelling in mind!).

This time we wisely arrived at Tigertail Beach on Marco Island around an hour before low tide. A cold weather system had moved into Florida, and it was in the low fifties (and windy) when we arrived at the public beach parking area. This is not a huge parking lot so arriving early is wise for many reasons. We had carefully looked at satellite images of this area in advance, and also had heard that one could wade across a shallow lagoon to get fast access to the gulf-side beach. That lagoon was not so shallow and after my husband Gary quickly was up to his thighs, with what looked like deeper water ahead, we decided to take the alternate route to the beach, by hiking south and around the lagoon, then hitting the beach on the southern end. I'm glad we did, as the beach, and especially the sandbars, exposed by low tide, were very rich in empty shells. By the way, although this is not a

Figure 1. *Scaphella junonia*, a slightly worn specimen as it appeared in a narrow channel revealed by low tide. Tigertail Beach, Marco Island, Florida.

Figure 2. *Dinocardium robustum*, the Atlantic Giant Cockle. There were many large live specimens, as well as many single valves, on and in the sand at Marco Island. This one was actively burrowing into the sand as the tide came in. This species can grow up to 5 inches in length and there were many of this size on Tigertail Beach.

ISSN 0738-9388

state park, there are signs all over stating "No Live Shelling" at Tigertail Beach, so be forewarned. The empty shells were excellent, though, and my best shelling of the trip happened here, as we hiked north towards the northwest corner of the island.

Figure 3. A "colony" of Florida Fighting Conchs, Marco Island, Florida. There were many groups like this, revealed by low tide, with easily a dozen or more, just a few inches apart, in each group. We never saw densities like this of these conchs elsewhere.

Figure 4. A nice mature, live *Strombus alatus*. Tigertail Beach, Marco Island, Florida.

ISSN 0738-9388

Figure 5. A good-sized empty Sunray Venus. Marco Island, Florida.

Figure 6. *Triplofusus giganteus*, the Florida Horse Conch, in its new home (in my study). This shell is about 10.5 inches in length. Found empty at the peak of low tide on a sand bar before the crowds descended, Tigertail Beach, Marco island, Florida.

ISSN 0738-9388

Day Four:

My brother lives in Pinellas Park near St. Petersburg, so we decided to make the most of the shelling in that area, since we wouldn't meet up with him until 5 p.m.

My brother Malcolm, who has lived in the Tampa bay area for many, many years, recommended Fort De Soto State Park for birding (which was another goal of the trip) and Honeymoon Island for shelling. In the end, after spending about an hour early in the morning at Pass-a-Grille Beach with its small breakwater (which had captured some nice shells, including an empty but intact *Dinocardium robustum* with both valves) we spent the entire morning and early afternoon at Fort De Soto State Park, as it was good for shelling and birding. Honeymoon Island (which is also a state park) will have to wait for the next trip! The shelling along the wrack line seemed to get richer and richer as we hiked north long the north-south gulf-facing portion of the park. We met another (local) sheller who confirmed that this pattern is not random, but that many intact shells tend to get caught on that northernmost point. Once we rounded the northern tip and entered the bayside, the shells tapered off, but the bay side had nice empty shells of its own.

Figure 7. *Haminoea antillarum*, the Antilles Glassy-bubble. Several of these empty shells were washed up on the bay side, filled with mud. Most of them were in excellent condition and cleaned up nicely. These are about 10 mm in length. Fort De Soto State Park, Florida.

Day Five:

This had to be a fairly short day as we would be getting up well before dawn the next day to fly back to San Diego. So we explored Stump Pass State Park, which is at the south end of Manasota Key (close to our motel). The beaches yielded similar empty shells to what we had seen elsewhere previously, but the richness of shells increased as we walked south to the small channel at the south end of Manasota Key. Right at the channel, where water was rushing out towards the Gulf, some pelicans were fishing just a couple feet from the shore, and then we saw a shark join the pelicans in the fishing there! This drove home the reality that snorkeling in the Gulf should be done with caution, and an understanding of the creatures you are swimming with! This particular day seemed to be the coldest one yet, and we were bundled in multiple layers, so I was not even considering getting in the water, but still - the shark was an interesting wake-up call!

Figure 8. Shelling in the chilly weather, Stump Pass State Park, Florida.

ISSN 0738-9388

Figure 9. *Donax variabilis* (or Coquina), one of what seems like an infinite number of variations of the color and pattern of this species! Stump Pass State Park, Florida.

If I had to do this trip over some time, I think I would try to plan a slightly longer stay. Five days (or more accurately, four-and-a-half), especially with traveling as widely as we did, did not make for the most relaxing experience! Something else that was driven home by this trip, is that it's critical to arrive at beaches early in the day, and before low tide, especially at well-visited beaches. I'm glad that we decided to visit a variety of places, though, as originally I had planned to stay at Sanibel Island almost exclusively. I also did not leave enough room in my luggage for shells. I could have mailed some of the shells home, but decided instead to mail my snorkeling gear (which got almost no use) instead. This opened up room in my bags for my carefully-wrapped shells (with temporary data labels), which took up even more space than I thought they would! I ended up buying Ziploc bags, paper towels for padding and some inexpensive plastic food storage containers for the shells for the return trip. Englewood has grocery stores that are very convenient for such purchases. Having a motel with a full kitchen including refrigerator and freezer was extremely helpful, also!

Now the fun of cleaning, organizing, properly labeling and storing my finds from this trip begins!

ISSN 0738-9388

Bulla gouldiana Plisbry, 1895 off Santa Barbara Island

Laurel Silver-Valker[‡]
2696 Dietrich Drive, Tustin, California 92782
laurelthediver@yahoo.com

Diving is one of the greatest joys in my life. It is calm, peaceful and serene. I get to commune with nature, and deep underwater I feel most at home. I help out on dive ships so that I can afford to go diving often. On a recent dive off Santa Barbara Island, California, in approximately 55 feet of water on muddy sand I spotted a large colony of "bubble snails" - both live ones and dead ones. The live animals had a mottled white-tan pattern on an orange-gold foot. I brought back a bunch of dead shells and took pictures of the live ones.

It turns out that I found *Bulla gouldiana* Pilsbry, 1895, a coastal species that is generally found in much shallower waters from intertidal to ten meters. (Malaquias, M.A. and D.G. Reid. 2008. Systematic revision of the living species of Bullidae (Mollusca: Gastropoda: Cephalaspidea), with a molecular phylogenetic analysis. Zoological Journal of the Linnean Society 153:453-543, and p. 497.) This appears to be both a range extension to the offshore islands and a greater known depth for the species.

Figure 1. Live *Bulla gouldiana*

Figure 2. *Bulla gouldiana* 41.3mm from 55 feet depth off Santa Barbara Island

[‡] Laurel Silver-Valker was lost while diving off Ship Rock in Catalina on December 29, 2015.

ISSN 0738-9388

How I Started Collecting Cowries

William Schramm
24151 Las Niranjas Road, Laguna Niguel, California 92677
bschramm@ive.edu

I started collecting seashells during one of my summer breaks with little to do while waiting for the fall semester of college to start. It was during this time that I would head to the beach on most clear days.

Upon finding a nearly perfect, or so I thought at the time, knobbed whelk rolling back and forth in the surf during one of my beach visits, I decided to continue looking for other shells brought to the shore by the relatively gentle waves of the Long Island Sound in New York. Soon my collection grew to include such local shells as mussels, clams, cockles, periwinkles, "turrets" and many others. But as you may already know you don't find cowries on the beaches of New York. Well, that was "o.k." since at that time I didn't even know of the existence of such beauties. The next summer came along and I decided to expand my collecting area so off I went, traveling the roads to the most well known get-away location for New Yorkers – Florida. So naturally I stopped at every shell shop I came across from South Carolina to the Caribbean. It is embarrassing to admit that somewhere between 99% and 100% of my collecting was done this way. Maybe I thought that all beaches, at least in this country, was as semi-sterile of shells as the beaches back home.

Well with school finally over, I shipped myself to a new venue in southern California to attend graduate school. By now marriage and all that good stuff that goes with it, such as house, family, and work, left me with precious little free time - so my seashell collecting nearly grounded to a halt. If it wasn't for my wife bringing home several nearly soccer ball size shells a few times from the county fair, the collection's growth rate would have averaged close to 0% for over several decades. Oh yea, there was one event, during this time period, that introduced me to not only what shell collecting could be like but also an opportunity to obtain some nice specimens. This took place because my best friend and amateur astronomy-observing buddy, is an attorney. He had an elderly client that had been a serious shell collector in years gone by and I was invited to the client's home and while my friend and his client were involved in legal matters I was involved with setting aside shells that the owner was willing to part with. By now I had a few cowries and I wasn't exactly looking for more so I was unprepared for the great find that occurred involving someone else collection. It was a five-inch *Cypraea tigris schilderiana* Cate, 1961, and I obtained it for twenty-five dollars! The largest cowrie I had at home was puny in comparison. But even this wonderful acquisition didn't start me
down the road to specialize in *Cypraea*. Unfortunately, with time the inevitable happened, I retired. I did have four or five hobbies, family matters and still working part time to keep myself occupied but I was really anxious to become more active with my shell collection and therefore I became curious about what might be going on at any of the local shell clubs. Well there weren't many shell clubs around but I did zero in on the San Diego Shell Club, located about 60 miles from where I live, so I attended one of their auctions. There was no shortage of great looking shells to bid on but the

ISSN 0738-9388

situation was somewhat intimidating since the attendees seemed to know a lot more than I did about shells. Even thought the bid prices were rather modest I couldn't bring myself to bid on something.

At that time I was mostly interested in cones and I couldn't find any members in the Club that expressed much interest in cones. Go figure. But I did find someone who was both congenial and also knowledgeable about cowries. After being invited to view his cowrie collection I became aware of the great variety of cowries that exist and how to protect and display them. This type of interaction certainly underscores the importance of being involved with other people that have a similar interest. All this took place over a rather short period of time and I'm sure this is why I gravitated so seriously towards collecting cowries.

Along the way I was introduced to an enormously valuable resource called Tideline, a retail establishment that is located near Los Angeles. Tideline specializes in natural marine items such as sand, coral, and high quality seashells. The proprietor is a world-class cowrie collector and has proven invaluable to me for cowrie additions to my collection. I was also introduced to several well-known cowrie collectors and dealers that tend to stop by Tideline on their way to or from major shell events such as the Paris or Tucson show. Coming in contact with people like these there is little wonder that in less than three years I went from six, almost nothing-special cowries, to over two hundred and twenty five cowries. This does not include any duplicates. Well, I guess that one could say that I was now hooked on cowries. So how can I then explain that I recently trading a *Cypraea tessellata*, a *C. tristensis*, and a few dollars for a 9-inch wide by 10-inch long imperial volute? Um ... I wonder if in a couple of years, all my cowries will turn into volutes. Oh no, if this happens I'll have to write an article on how I became a volute collector. When will this ever end?

Figure 1. Knobbed whelk (on my way to becoming a shell collector)

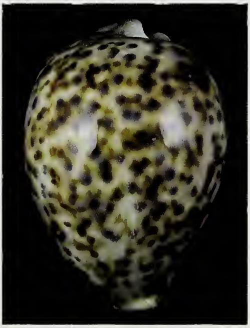


Figure 2. Cypraea tigris schilderiana (deal of the decade)

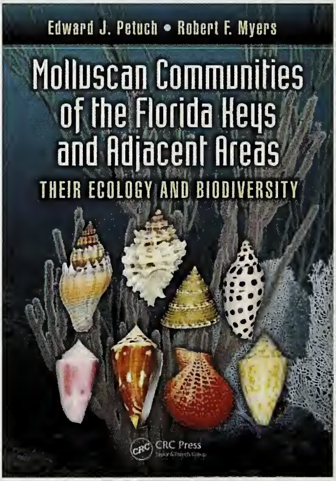
Figure 3. Imperial volute (thanks Larry)

ISSN 0738-9388

Molluscan Communities of the Florida Keys and Adjacent Areas: Their Ecology and Biodiversity
by Edward J. Petuch and Robert F. Myers

Published 2014, CRC Press - Taylor & Francis Group, Boca Raton, Florida, ISBN 13: 978-1-4822-4918-7 in hardcover with laminated board case binding, 299 pp., illustrated in high color resolution photographs by Robert F. Myers, about $120

Review by David P. Berschauer
shellcollection@hotmail.com



This book is organized and arranged by habitats, the way a field collector or ecologist would approach a collecting trip or expedition rather than the traditional taxanomic hierarchy. The authors lead the reader through an exploration of twenty different marine ecosystems from the Palm Beach region south through the Florida Keys, across the Dry Tortugas and through the vast Ten Thousand Islands region - an area encompassing the southern extreme of the Suwannean Molluscan Subprovince of the Carolinian Molluscan Province and represents an ecological transition zone. This book is unique by being the first book on mollusks of the greater Florida Keys region organized by marine ecosystems and their associated molluscan assemblages arranged by the CMECS (Coastal Marine Ecological Classification Standard) system.

More than 1,200 species in 140 families are noted from the study areas, with large glossy color plates illustrating over 550 of the region's most ecologically important species. Along with species lists for each of the twenty marine ecosystems and associated molluscan assemblages surveyed, the authors describe two new species of bivalves in the families Pectinidae and Arcidae, and ten new gastropod species in the families Muricidae, Buccinidae, Nassariidae, Naticidae, Turritellidae, and Olividae. Finally, for the land snail enthusiasts there is a chapter on the endemic tree snails of the Florida Keys tropical hardwood hammocks, with rich illustrations of many of the rarest subspecies and forms.

I found this book to be both an enjoyable read and a useful and valuable reference guide. If you collect shells or ever plan to collect shells in Southern Florida this book is a fantastic addition to your shell library.

ISSN 0738-9388

Uncle David Left Me What?

David Waller
505 N. Willowspring Dr., Encinitas, California 92024
dwaller@dbwipmg.com

Like many of you I am the Collector of my family. I collect shells, stamps, gemstone and a variety of other treasurers. Over the years, I have had to control my collecting for a number of reasons, primarily because it can be very expensive. Now I focus my collecting efforts on seashells, particularly cowries. Even though I am not a general collector, the Cypraeidea in my collection now exceed 1,500 specimens.

I enjoy my shells and devote, much of my spare time to cleaning them, placing them in protective cases, logging their collection data into my computer database and storing them in clear Plexiglass wall mounted cabinets as well as cardboard specimen boxes in the closet. I have spent a lot of time curating my collection and a bit of my financial resources to purchasing these fabulous gems of the sea. But I worry about who will enjoy them when I am gone. I am still relatively young and will have a lot of time to enjoy my collection and may eventually sell them before I leave this life. However, what if something happens and my family inherits a collection of shells that they have no interest in and have no idea of their value. These questions are the makings of a Collector's nightmare. Will they be discarded as so much trash? Will a shell dealer steal away with my shells for pennies on the dollar? Or will my wife make good on her promise to create a mosaic coffee tabletop out of the broken pieces of my cowries? This would make any Collector awake from such a dream in a cold sweat. So what do we do? How do we assure that our shells will be enjoyed by others in the future and that our families are compensated appropriately for our collections? This is the subject of four articles relaying my experiences in this area to be published this year, one in each publication of *The Festivus*. I heard many options. Gift your collection to a museum, disperse them to family and friends, donate portions of your collection while you are living to obtain the tax benefits, train your children and/or spouse about shells so that they have an idea of their value and secure connections for their sale when you are gone, or make a gift of your collection to a non-profit organization such as a shell club.

This article provides my thoughts and information I obtained when considering the benefits and disadvantages of gifting my collection to a museum or to friends and family.

My first thought was what better place than a museum for my collection. They will display my shells with signs stating "The Waller Collection", others will see my shells and be inspired to collect in the future and it will be a place where my children can go to see the family collection and feel proud of our contribution. What a utopian thought.

My next thought was what about giving that beautiful *Cypraea fultoni* to my son. He will proudly display it on the fireplace mantle and every time he sees it he will remember Dad. Or that 150mm *Cypraea tigris* that I could will to my best friend. He will surely keep it on his desk and think of all the good times we had over the years. More wishful thinking.

Unfortunately, reality is very different from many of our hopes and dreams. So what about donating my shells to a Natural History Museum? With more thought, I began to realize that while the local Natural History Museum is a storehouse containing many natural wonders, it is also, in part, a research institution.

ISSN 0738-9388

Many of us who have written articles for journals like *The Festivus* have used museums as a resource for shells and shell information that we do not have in our own collections. Because of this, museums are hesitant to accept collections from individuals who are not known for personally collecting specimens. Collection data is golden for museums and the condition of a specimen often takes a back seat to this information.

When I approached museums about donating my collection I was very surprised by their response. First, they were not overly pleased and appeared as though this was going to be a great burden on their department. They asked if all of the shells had data and was the data reliable. This does not mean the little slip of paper that says "Philippines". They mean the original collecting slip that contains the name and size of the shell, the date it was collected, the location (preferably with GPS coordinates), the collector's name as well as the expedition name if any. They also indicated that if it was my desire that my collection be shown or that the shells be stored together as a collection that this was definitely impossible. The shells would be distributed to the "winds" of their collection and there would be no display honoring my collection whatever that contribution might be. The final nail in the coffin was their suggestion that without data they would likely discard the shells. I must have been visibly mortified by these comments and the candid manner in which they spoke about discarding portions of my collection. My response was a knee jerk reaction and may not have been as pleasant as I had hoped. This apparently was not a problem because the reaction I received from the museum seemed more of relief than insult.

I came away from these discussions with a sense of despair. I felt that the time and love I had contributed to creating this (in my opinion) magnificent collection was for naught and that my shells would just become one of many in the archives of the museum seen only indecently by those being shown the collections to inspire further financial donations. With this my thoughts turned to my son with the hopes that he would continue the collection adding significantly over his lifetime until he could give it to his son and so on. Well upon broaching the subject with him he proceeded to let me know exactly what he would do with my shells. He would place them in the car and make the 20 hour or so trip to La Jolla from Montana, perch himself comfortably on the cliffs high above the "The Caves" and proceed to launch my shells one at a time into the ocean shouting "Be Free". Well the quote from the Mork and Mindy TV sitcom was not lost on me and it was funny for about a half second. I then realized that family and friends do not necessarily have the same respect for items that I or another collector might have, and without additional knowledge like that supplied by my son, a gift to anyone other than a collector would likely be a grave mistake. Shell collectors often talk about leaving certain shells to one-another but unless someone knows specifically about that gift and it appears in the legal documents you will likely never get your wish.

In all honesty, there are relatively few personal collections that have the necessary data and shell composition to be of value to a Natural History Museum and mine is not a likely candidate for such a donation. Correspondingly, I realized that a gift to my son or a friend of an item that I hold in great esteem will not cause my friend or family to remember me. They will remember me because of who I am, the moments that we shared together and the feelings those memories generate, not from a shell. With this in mind, I looked into donating while I am still alive to take advantage of any benefit that might be available such as a tax deduction. This does not resolve the problem of what happens when I die unexpectedly, but it might help in collecting the necessary funds for that trip to Australia, New Zealand, Papua/New Guinea and New Caledonia. My findings on donating in my lifetime will be discussed in my next article.

ISSN 0738-9388

In Memoriam - Laurel Silver-Valker

By David P. Berschauer

I have known Laurel Silver-Valker for more than twelve years since our kids were in Boy Scouts and we were Troop leaders together. While sitting around the campfires at night waiting for the boys to quiet down and go to sleep Laurel and I used to discuss marine life, and she would tell me about her dives and lobster hunting. Laurel loved the ocean and was a dive master with over a thousand dives. Yes, I finally did it - I used the past tense in writing about my dear friend. On December 29, 2015 Laurel went missing while scuba diving off Ship Rock near Catalina Island. Search and rescue turned into a recovery operation after several days. To date she has not been found and what happened remains a mystery. Laurel was a very experienced scuba diver with a passion for life and for the mysteries of the ocean. It is ironic that she became one of those mysteries in the ocean, leaving us all wondering. For many of you who just met Laurel at our Club's holiday party, you could describe her as a 45 year old mother of two young adult boys, a very young grandmother, who was bubbly, vivacious and in love with the man of her dreams, Tom Gordon. What you might not know was that Laurel was a special education teacher who loved helping kids, loved yoga, was an enigma in that she was old fashioned naturalist and environmentalist yet was a self-stylized lobster hunter, or that she struggled with Fibromyalgia, an invisible medical illness, but refused to let it slow her down or define her. Having known Laurel for so long, and watching her struggle through the tough times in her life and overcome adversity I can tell you that she was a resilient strong woman who was in love with life and lived every day to the fullest, and she was in love and looking forward to getting married and spending the next fifty years or more living life, enjoying and exploring the world with her perfect guy. Many of her friends describe Laurel as a mermaid, and will tell you that she was never happier than when she was diving in the sea. "You can shed tears that she is gone or you can smile because she has lived." (from a poem by David Harkins)

ISSN 0738-9388

BACK COVER: Arrangement of shells collected in the Ten Thousand Islands, Florida. Photo by David P. Berschauer.

THE Festivus

Vol. 48(2) May 2016

Arctic Alaskan Mollusks
A new *Haliotis* from Yemen and Oman
African cone from the Saharan Coast
Dwarf white *Harpa* from Queensland
New land snail species

Quarterly Publication of the San Diego Shell Club

ISSN 0738-9388

THE FESTIVUS

A publication of the San Diego Shell Club

Volume: 48 | May 2016 | ISSUE 2

MEMBERSHIP AND SUBSCRIPTION

Annual dues are payable to the San Diego Shell Club Membership: Domestic/Foreign $20 (receive e-mail copy of *The Festivus*); Domestic $35 (receive *The Festivus* by mail), Foreign/outside the continental United States $55 (receive a copy of *The Festivus* by mail). Single copies of each regular issue are $10.00 plus postage.

Address all correspondence to:
The San Diego Shell Club, Inc.
P.O. Box 230988, Encinitas, CA 92023

REGULAR CLUB MEETINGS

Club meetings are held on the third Thursday or Saturday of the month, except April, September and December, at either 7:30 p.m. in Room 104, Casa del Prado, Balboa Park, San Diego, or at 12:00 noon at Holiday Inn Express, 751 Raintree Dr., Carlsbad, conference room or as noticed.

FACEBOOK

https://www.facebook.com/groups/620724271299410/

WEBSITE

http://www.sandiegoshellclub.com

Submit comments or suggestions regarding our website to our Webmaster David Waller at dwaller@dbwipmg.com.

FRONT COVER:

Live animal photo of *Harpa queenslandica* Berschauer & Petuch, 2016, taken by Tassey Weinreich in 2008 in the Cairns Region, Australia; photo used with written permission, all rights reserved.. (Cover artistic credit: Rex Stilwill)

MISSION STATEMENT

The San Diego Shell Club was founded in 1961 as a non-profit organization for educational and scientific purposes. More particularly to enjoy, study and promote the conservation of Mollusca and associated marine life through lectures, club meetings and field trips. Our membership is diverse and includes beginning collectors, scientists, divers, underwater photographers and dealers.

THE FESTIVUS is the official quarterly publication of the San Diego Shell Club, Inc. and is issued as part of membership dues in February, May, August and November. *The Festivus* publishes articles that are peer reviewed by our volunteer Scientific Peer Review Board, as well as articles of general interest to malacologists, conchologists, and shell collectors of every level. Members of the Peer Review Board are selected to review individual articles based upon their chosen field of expertise and preference. Available by request or on our website are:

- Guidelines for Authors
- Guidelines for the Description of New Taxa

Submit articles to Editor, David Berschauer, at shellcollection@hotmail.com

All correspondence pertaining to articles, including all submissions and artwork should be addressed to the Editorial Board.

UPCOMING CLUB EVENTS:

West Coast Shell Show: 5/21-22/16
San Diego Co. Fair: 6/5 - 7/4/16
Bizarre Bazaar: 7/16/16
Balboa Park Show & Sale: 8/20/16
September Party: TBD
November Auction: 11/19/16
December Party: TBD

Publication date: May 2, 2016

ISSN 0738-9388

TABLE OF CONTENTS

EDITOR'S NOTE: In the August 2015 issue of The Festivus we published an article by Chorchat Gra-tes on land snails. We are disappointed that the author may have provided incomplete information and may have used images identical to those previously published in Raffels Bulletin of Zoology without obtaining the proper permission in advance. We hereby acknowledge that the images provided by Chorchat Gra-tes in plates 14 and 15 and on the cover of our August 2015 journal are likely from Raffles Bulletin of Zoology 2011 59(1):39-46. We have since obtained written permission for the use of these images and hereby formally give recognition to Tan Heok Hui and Raffles Bulletin of Zoology for providing these images. We respectfully offer our sincerest apologies in the event that Chorchat Gra-tes' article did not properly provide such recognition in our August 2015 publication.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 2

Notes on Some Little Known Arctic Alaskan Mollusks

Roger N. Clark [1,2]

[1] Research Associate in Malacology, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, California 93105
[2] Associate in Invertebrate Zoology, Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, California 90007

3808 Pinehurst Dr., Eagle Mountain, Utah 84005-6007
insignis69@gmail.com

ABSTRACT Notes on the taxonomy, distribution and natural history of some eastern Chukchi Sea mollusks. Including: validation of the misunderstood *Neptunea middendorffiana* MacGinitie, 1859, based on its egg cases; discussion of the enigmatic *Anomalosipho rodgersi* (Gould, 1860), an older name for the enigmatic *Volutopsius callorhinus* Dall, 1877; the peculiar egg towers of what appears to be *Buccinum obsoletum* Golikov, 1980; new distribution records for *Colus sabini* (Gray, 1824), *Buccinum beringense* Golikov, 1980 and *Neoiphinoe echinata* Egorav & Alexeyev, 1998; the first record of brooding behavior in *Trichotropis bicarinata* (Sowerby, 1825); and the identity and validity of *Plicifusus johanseni* Dall, 1919, and *Pseudopolinices nanus* (Møller, 1842) a species in need of a new name.

INTRODUCTION From 2009-2013, I participated as an invertebrate taxonomist in a series of surveys in the eastern Chukchi Sea [Northern Alaska, North of the Bering Strait and west of Point Barrow (Figure 1)]; in 2009 on the CSESPA (Chukchi Sea Environmental Studies Program); in 2010-2011 on the AKMAP (Alaska Monitoring and Assessment Program) survey; a multi-year, state wide, near-shore biodiversity survey in 2012 on the Arctic EIS (Ecosystem Intergrated Survey), and in 2013 on the SHELFZ (Shelf Habitat and EcoLogy of Fish and Zooplankton) Project. This afforded me the opportunity to study the Arctic mollusk fauna. Many taxonomic, zoogeographical and natural history questions were investigated, and many rare and little known species were photographed alive for the first time. No diving was done on these surveys, but a large make shift onboard aquarium with natural substrate and invertebrate biodiversity allowed for live observations and *in situ*-like photography. The question of the validity of the Buccinid *Neptunea middendorffiana* MacGinitie, 1959 is answered by the discovery of its uniquely sculptured egg capsules. The identity of the enigmatic *Volutopsius callhorhinus* Dall, 1877 is discussed. The unusual branched tower egg masses of *Buccinum obsoletum* Golikov, 1980 are reported, the first Alaskan records for *Colus sabini* (Gray, 1824), *Buccinum beringense* Golikov, 1980, and *Neoiohinoe echinata* Egorov & Alexeyev, 1998 are presented, brooding behavior in *Trichotropis bicarinata* (Sowerby, 1825) is reported, the validity of *Plicifusus johanseni* Dall, 1919 is established, and the discovery that *Pseudopolinices nanus* is in need of a new name is reported. All collections were made by the author, and illustrated specimens are in his personal collection. Vouchers for new distribution records are deposited in the Santa Barbara Museum of Natural History.

Family: Capulidae

Neoiphinoe echinata (Egorov & Alexeyev, 1998) was described from the Tartar Strait, on the west side of Sakahlin Island, Russia (48°15.4 N, 154°37.4 N) (Kantor & Sysoev, 2006); the strait connects the northern Sea of Japan to the Sea of Okhotsk. The species resembles *Neoiphinoe kroyeri* (Philippi, 1849) in form, but is more slender and is characterized by four spiral rows of setae. The apex of Arctic specimens is frequently eroded. On 27 August, 2009, 3 specimens (Figure 2) were taken northwest of Icy Cape (71°07.19 N, 163°48.2 W) (CSESPA 2009-BF001) at 40 m, on 29 August, 2009, 4 more specimens (Figure 3) were taken at 40 m, about 30 km to the NW, at (71°08.87 N, 164°28.72 W) (CSESPA 2009-KFO25), and on 5 September, 2012 a single specimen (Figure 4) was taken North of Point Franklin (71°29.92 N, 159°03.22 W) (162-2012-2-75) at 50 m, with a bottom temperature of -1.68° C. Maximum length: 19.1 mm (apex missing).

On 8 August 2010, two specimens of *Trichotropis bicarinata* (Sowerby, 1825) (Figure 5) were taken in Ledyard Bay, NE of Cape Lisburne (69°10.37 N, 165°42.56 W) (AKCH10-017), at 22 m, together on the dead shell of a small *Neptunea ventricosa* (Gmelin, 1790); one small male (24 mm), and a much larger female (45 mm). The female was found sitting on a cluster of seven transparent capsules (Figure 6), each about 10-12 mm in diameter, with 8-12 young within; the tiny yellow juveniles, each about 1.5 mm in diameter. The entire cluster fit perfectly within the aperture of the snail. A second female individual (Figure 7, 36 mm) was taken in the same haul, sitting atop a similar but smaller, more recently deposited clutch of capsules on a small stone; the juveniles within, each about 0.8-0.9 mm in diameter. This suggests that *T. bicarinata* broods its young, perhaps until they hatch and disseminate. Similar brooding behavior has been reported in the genus *Capulus* Montfort, 1810 (Abbott, 1968). This species was taken throughout the eastern Chukchi Sea at depths of 12-56 m with bottom temperatures of -0.4°C to 9.1°C.

Family: Nacticidae

"Pseudopolinices" nanus (Møller, 1842), described as a *Natica*, Golikov & Sirenko (1988), erected the genus *Pseudopolinices* for this unusual species. A single specimen of this tiny species was taken 13 September 2011, off Solivik Island, Icy Cape (70°13.37 N, 162°35.08 W) (AKCH11-052), at 17 m. On 9 September 2012, two more specimens (Figure 8) were taken West of Icy Cape (70°29.57 N, 168°29.4 W) (162-2012-2-118), at 39 m, with a bottom temperature of 0.0°C. Originally described from West Greenland, this species has been recorded throughout the Arctic and circum-boreal region (Oldroyd, 1927; Baxter, 1987; Golikov & Sirenko, 1998; Kantor & Syseov, 2006). The problem arises when one tries to match the Holotype, illustrated by Schiøtte & Warén (1992) with the form presently recognized as *P. nanus*. The Lectotype (Figure 9) is clearly a *Euspira*-like species with a prominent umbilicus and a thin, tenacious yellow-brown periostracum, whereas the form presently recognized as this species has a glossy white shell, apparently no periostracum, and a thick, *Cryptonatica*-like callus over the umbilicus. The operculum is corneous like in *Euspira*. It seems this unusual little naticiid is in need of a new name.

Family: Buccinidae

Neptunea middendorffiana MacGinitie, 1959 (Figures 10-12) has long been confused with its congeners *Neptunea heros* (Gray, 1850) (Figures 13 & 14) and *Neptunea ventricosa*

(Gmelin, 1790) (Figures 15 and 16). Macintosh (1976) considered it a synonym of *N. heros*, Abbott (1974) considered it to be synonymous with *N. ventricosa*, and Kantor & Sysoev (2006) also considered it a synonym of *N. ventricosa,* but considered *N. heros* to be *N. ventricosa,* and *N. ventricosa* to be *N. behringiana* (Middendorff, 1848). Baxter (1987) considered it a valid species, Tiba & Kosuge (1988) listed it as a synonym of *Neptunea bulbacea* (Valenciennes, 1858), a larger species restricted to the NW Sea of Japan and southern Okhotsk Sea, Feder, *et. al.* (1994) listed it as a valid species, Fraussen & Terryn, 2007 sorted out the *N.heros/N. ventricosa/N.behringiana* problem, but erroneously re-named what they believed was *N. middendorffiana,* from Northern Japan and the southern Kurile Islands, and *Neptunea magananimita* (Fraussen & Terryn, 2007), based on the belief that the holotype of *N. middendorffiana* was a young specimen of *Neptunea heros,* this however is a completely different species. The problem arises from the fact that, until now, very little material was available from Arctic Alaska and the morphological similarities between the three nominal species are impressive. However, MacGinitie's original description is quite adequate for recognizing the species. Trawled samples would sometimes contain hundreds of specimens of these three species, and they were easily separated by: (1) shell form, *N. heros* is variable in form, squat to elongated, shoulder may be smooth, knobbed (5-7 knobs), or have a single whitish rib with some specimens having varices. *N. ventricosa* is also variable and may be smooth, spirally ribbed or variced; it may be separated from both its congeners by short twisted canal. *N. middendorffiana* is consistently smooth except for a single (often faint) rib at the shoulder, which is generally somewhat darker than the rest of the shell with the rib having as numerous (9-15+) small knobs. (2) shell color, *N. heros* is variable in color, tan, pink, purplish, brown or white and the apertures may be white (often flushed on the lip with pink-purple), purplish or brown, occasionally specimens with intensely orange or red-orange apertures are found. The shells of *N. ventricosa* are brown, tan or reddish-brown and the apertures are typically the same color as the exterior of the shell, though rarely some may have a white aperture. In *N. middendorffiana,* the shell is uniformly purple-brown. However due to the plasticity of the former two species, *N. middendorffiana* has been treated as a synonym of the two former species. MacGinitie, 1959 suggested the possibility that her new species might conceivably be the small male form of *N. heros* or *N. ventricosa*, and remarked that the protoconch was most similar to that of *N. ventricosa.* However numerous male and female specimens of all three species were taken in 2012 and 2013, supporting *N. middendorffiana* as a distinct species, and finding of egg capsules (Figure 17) at several stations in 2013 proved its validity beyond doubt. The egg capsules are deposited in single layer clusters, like those of *N. heros* (Figure 18), unlike the towers deposited by *N. ventricosa* (Figure 19), and the smaller *Neptunea borealis* (Philippi, 1850) [I still use *N. borealis* for Alaskan form, as I am not convinced that *Neptunea multistriata* (Aurivillus, 1885) is distinct] with which it also occurs. The egg capsules are erect and flap-like, with a slender pedicle, and measure 21 x 12 mm. The capsules are uniquely sculptured, with 4 radiating ribs, contrasting with the similarly shaped capsules of *N. heros* which are much larger, up to 35 x 20 mm, and are sculptured with countless minute dimples.

Neptunea middendorffiana has a somewhat patchy distribution, in the northeastern Chukchi Sea. It was collected at twelve stations, from the general vicinity of Point Barrow (71°15 N, 157° W) (162-2013-2-25), where it is locally abundant, south, to NW of Cape Lisburne

(170°00.22 N) (162-2012-2-120) at depths of 26-110 m on boulders and gravel, with a bottom temperature of -1.7°C to 2.0°C. It apparently does not penetrate (at least not much past Barrow) into the Beaufort Sea (based on 2008 NOAA trawl survey data/images). I have also seen a specimen from an unknown location in the Bering Sea. Maximum length: 77.7 mm.

The enigmatic *Volutopsius callorhinus* Dall, 1877 was described from a badly eroded, "beach worn" shell with a broken canal, from the Pribilof Islands. A recent examination of the type verified its deplorable, almost useless condition, "one sand-blasted shell" (Ellen Strong, *pers. com.* 2013). I originally thought that the name corresponded to a similarly shaped shell from the Aleutian Islands. However the description of *"V."callorhinus* says that the type(s) (Figure 20) shows traces of spiral striae while the Aleutian species is smooth. Also the Aleutians species has not been found near the Pribilofs. In Arctic Alaska there is a *Colus* like species that has hitherto been called *Colus* or *Anomalosipho verkruezeni* (Kobelt, 1876) [*syn. Colus dautzenbergii* (Dall, 1916)] (Abbott, 1974), but that species is restricted to the Norwegian, Barents and Kara Seas (Kantor & Sysoev, 2006). Feder, *et. al.* (1994) listed both *Volutopsius callorhinus* and *Colus dautzenbergii* from the NE Chukchi Sea, and Baxter (1987) called it *Plicifusus callorhinus*. MacGinitie considered it a smooth form of *Plicifusus kroyeri* (Möller, 1842). Dr. James H. McLean discovered a forgotten name for the Alaskan species, *Buccinum rodgersi* Gould, 1860 (Figure 21), described from 36-72 m near the Bering Strait, and now placed in the genus *Anomalosipho* (J. H. McLean, *pers. com.* 2012). A comparison of this species with the type of *Volutopsius callorhinus* leaves little doubt that they are conspecific. The species ranges from the Pribilof Islands to the Barrow region. *Anomalosipho rodgersi* (Figure 22) was taken at just three stations, two near Bering Strait at 50-52 m (66°01.07 N, 168°29.73 W) (162-2012-2-2) and (66°29.71 N, 168°29.70 W) (162-2012-2-124), and one from Peard Bay, near Point Franklin, SW of Barrow (71°00.25 N, 158°04.59 W) (AKCH11-047) at 27 m, and a bottom temperature of 1.5° C. Maximum length: 59.5 mm.

Colus sabini (Gray, 1824) (Figures. 23 and 24), is well known from the North Atlantic-Arctic region, ranging from the Gulf of Main (Abbott, 1974) to the East Siberian Sea (Kantor & Sysoev, 2006) also occurs in the Beaufort Sea (James H. McLean, *pers. com.* 2010). This fragile species was taken at seven stations between Cape Lisburne (69°29.99 N, 168°33.63 W) (162-2012-2-61) and north of Barrow (71°59.25 N, 157°09.39 W) (162-2012-2-76), at depths of 51-87 m and bottom temperatures of -1.6°C to 3.7°C. This is the first record of this species in the Chukchi Sea, establishing it as circum-Arctic. The Chukchi specimens nearly always had the parasitic anemone *Allantactis parasitica* Danielssen, 1890 (Figure 24) (Ident. K. Sanamya, *pers. com.* April, 2015) attached to the shell. Maximum length: 84.6 mm.

Plicifusus johanseni Dall, 1919 (Figures 25 and 26), is a rather enigmatic species, MacGinitie (1959) did not report it. Abbott (1974) and Baxter (1987) listed it as valid, Kantor & Sysoev (2006) considered it valid, and Kosyan & Kantor (2012) also considered it valid, but based on the very poor condition of the syntypes and lack of better material, expressed uncertainty as to whether the species was recent or fossil. The main character separating this species from the similar but larger *Plicifusus kroeyeri* (Möller, 1842) (Figure 27) is considered to be the lack of axial ribs on the penultimate whorl. However this character has proved to be unreliable in fresh material. *Plicifusus johanseni* may be distinguished from

P. kroeyeri by: (1) smaller, more slender shell; (2) very fine, uniform spiral lirae, compared to *P. kroeyeri* which has fine incised lines, becoming spaced further apart on the base; (3) fewer, more consistent number of axial ribs, 12-14 compared with typically 18-28 (very rarely fewer) in *P. kroeyeri* of the same size; and (4) the axial ribs of *P. johanseni* are less prominent than those of *P. kroeyeri*, typically (but not always) becoming faint or absent on the penultimate whorl. *Plicifisus johanseni* was taken at eight stations in 2012 and one in 2013, between WNW of Cape Krusenstern (67°30.54 N, 165°52.28 W) (162-2012-2-16) and North of Barrow (71°31.42 N, 157°23.25 W) (162-2012-2-48), and as far north as (72°30.63 N, 166°50.26 W) (162-2012-2-92), NW of Icy Cape, at depths of 38-91 m and bottom temperatures of -1.6°C to 4.9°C. Maximum length: 74.85 mm.

On 16 September 2011 several very strange egg masses were recovered from 110 m in Bering Canyon (71°21.99 N, 158°51.62 W) (AKCH11-064). The egg capsules were of the *Buccinum* type, thin, whitish, flap-like, but were deposited in slender, coiled towers, which branched repeatedly, in a tree-like fashion (Figure 28), something unheard of in *Buccinum*, which generally deposit eggs in irregular masses or mounds, though some species (*i.e. Buccinum scalariforme* Møller, 1842 (Figures 29 and 31) and *Buccinum plectrum* Stimpson, 1865) (Figures 30 and 32) lay irregular, tower-like mounds. The egg capsules themselves very from flap-like to lenticular, and may be soft as described above, or more inflated and rigid as in *Buccinum glaciale* Linnaeus, 1761 (Figures 30 & 33). The only unusual species of *Buccinum* taken in the sample was *Buccinum obsoletum* Golikov, 1980 (Figure 35). Fortunately, many of the capsules were near to hatching and the juvenile snails were collected. The juveniles (Figure 34) appear to be those of *B. obsoletum.*

Buccinum obsoletum was described from the northern Okhotsk Sea, but is reported to range into the northern Bering, Chukchi and East Siberian Seas at depths of 18-146 m (Kantor & Sysoev, 2006). However, it has never been reported from Alaskan waters. In 2012 and 2013, *B. obsoletum* and its apparent egg "trees" was collected at eight stations, from northwest of Cape Lisburne, (69°30.10 N, 167°07.30 W) (162-2012-2-57), to North of Barrow (71°41.32 N, 156°41.62 W) (162-2013-2-16), at depths of 43-110 m, with bottom temperatures of -1.7°C to 5.4°C. Maximum length: 55.6 mm.

Buccinum beringense Golikov, 1980 (Figure 36), was described from the western Bering Sea, but has not been reported from Alaskan waters. In August, in 2011, a single specimen was taken northwest of Wainwright (70°55.1 N, 160°54.31 W) (AKCH11-059), at 51 m. Specimens were taken at four stations in 2012 & one station in 2013, between Kotzebue Sound (66°30.05 N, 162°12.48 W) (162-2012-2-10) and North of Barrow (71°41.32 N, 156°41.62 W) (162-2013-2-16), at depths of 12-82 m, with bottom temperatures of -1.5°C to 2.1°C. This looks to be what MacGinitie (1959) called *Buccinum moerchianum* (Dunker, 1858) (Figure 37), which is a Gulf of Alaska species, not found in the Arctic. Maximum length: 77.8 mm.

ACKNOWLEDGMENTS

I wish to thank Dr. Stephen C. Jewett, Mr. Douglas Dasher and Dr. Arny Blanchard of University of Alaska Fairbanks, Institute of Marine Science; Dr. James H. McLean (Emeritus), and Mr. Lindsey Groves of the Los Angeles County Museum of Natural History; Dr. Ellen Strong of the Smithsonian Institution; Dr. Henry Chaney of the Santa Barbara Museum of Natural History; Mr. Bob Lauth, Dr. James Orr, Dr. Lyle Britt, and Dr. Elizabeth Loggerwell of NOAA/NMFS, Alaska Fisheries Science Center;

Dr. Leandra de Sousa of the North Slope Borough, Dept. Wildlife Management; Dr. Karen Sanamya of the Pacific Institute of Geology, Kamchatka Branch; Dr. James McCarthy and Adam Baldinger, of the Museum of Comparative Zoology, Harvard University; and the Captains and Crews of the M/V Western Wind, R/V Norseman II, and F/V Alaska Knight. The comments of two anonymous reviewers are also gratefully acknowledged.

REFERENCES

Abbott, R.T. 1974. American Seashells, 2nd. ed. Van Nostrand Reinhold Co., New York. 663 pp., 4000+ figs., 24 plts.

Abbott, R.T. 1968. Seashells of North America. Golden Field Guide, Western Publishing Company, Inc. New York. 280 pp.

Baxter, R. 1987. Mollusks of Alaska. Shells and Sea life Pub., Bayside, California. 163 pp.

Feder, H.M., N.R. Foster, S.C. Jewett, T.J. Weingartner, and R. Baxter. 1994. Mollusks in the northeastern Chukchi Sea. *Arctic* 47(2): 145-169.

Fraussen, K., and T. Yves. 2007. *A Conchological Iconography*, Family Buccinidae, Genus *Neptunea*. ConchBooks, Hackenheim. 166 pp., 154 plts.

Golikov, A. N., and B.I. Sirenko. 1998. Prosobranch Gastropods of the Continental Slope of Kurile Islands. *Ruthenica* 8(2): 91-135.

Kantor, Y.I. and A.V. Sysoev. 2006. Marine and Brackish water Gastropods of Russia and adjacent countries: an illustrated catalogue. Moscow: KMK Scientific Press. Ltd. 371 pp. 140 plts.

Kosyan, A. R. and Y.I. Kantor. 2012. Revision of the genus *Plicifusus* Dall, 1902 (Gastropoda: Buccinidae). *Ruthenica* 22 (2): 55-92.

MacGinitie, N. 1959. Marine Mollusca of Point Barrow, Alaska. Proceedings of the United States National Museum Vol. 109 (3412): 59-208, 27 plts.

MacIntosh, R.A. 1976. A guide to the identification of some common eastern Bering Sea Snails. Processed report. March, 1976. NOAA/NMFS, Northwest Fisheries Science Center, Kodiak, Alaska.

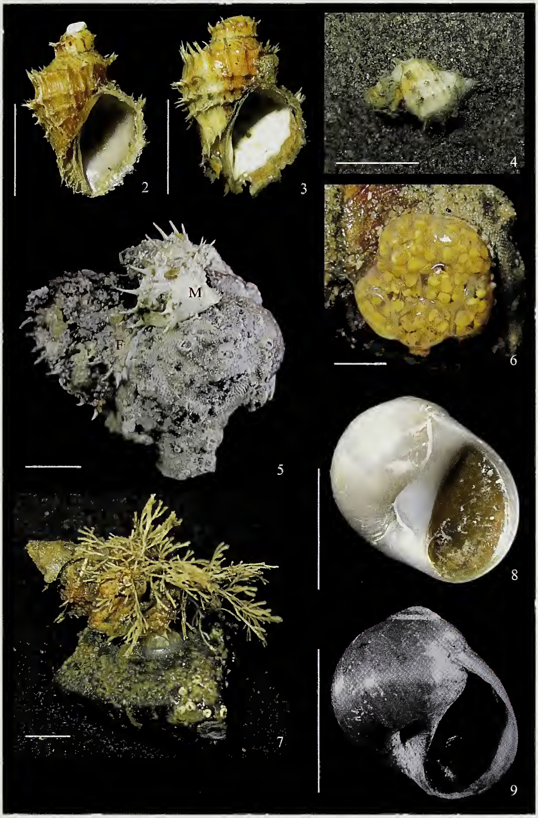
Oldroyd, I.S. 1927. The Marine Shells of the West Coast of North America, Vol. II part II. Stanford University Press. 339 pp. 35 plts.

Schiøtte, T., and A. Warén. 1992. An annotated and illustrated list of the types of Mollusca described by H. P. C. Møller from West Greenland. *Bioscience* 32. 33 pp.

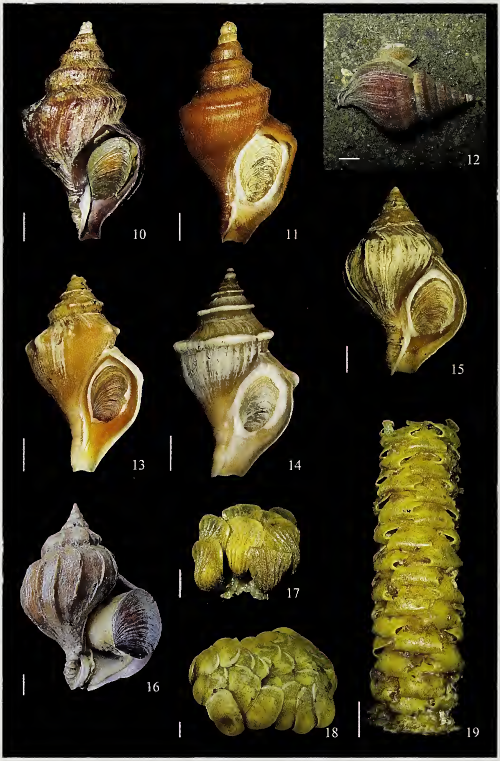
Tiba, R. and S. Kosuge. 1988. North Pacific Shells (17) Genus *Neptunea* Roeding. *Occasional publications, Institute of Malacology*. Tokyo. 96 pp.

ISSN 0738-9388

Figure 1. Map, Eastern Chukchi Sea, Arctic Ocean, Alaska.

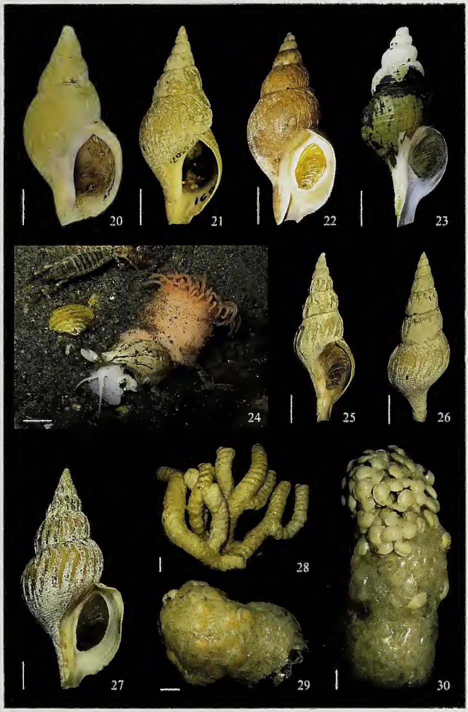


Figures 2-4. *Neoiphinoe echinata* (Egorov & Alexeyev, 1998). Figure 2. NW of Icy Cape (71°07.19 N, 163°48.2 W), 40 m (*leg.* Aug. 2009); Figure 3. NW of Icy Cape (71°08.87 N,164°28.72 W), 40 m (*leg.* 29 Aug. 2009) Figure 4. Live animal, N of Point Franklin (71°29.92 N, 159°03.22 W), 50 m (*leg.* 23 Aug. 2012) (bars = 1 cm). **Figures 5-7.** *Trichotropis bicarinata* (Sowerby, 1825), Ledyard Bay, NE of Cape Lisburne (69°10.37 N, 165°42.56 W), 22 m (*leg.* 8 Aug. 2010) (bars = 1 cm). **Figures 8-9.** *"Pseudopolinices" nanus* (Møller, 1842). Figure 8. West of Icy Cape (70°29.57 N, 168°29.4 W), 39 m (*leg.* 9 Sept. 2012); Figure 9. Lectotype (after Schiøtte & Warén, 1992), West Greenland (bars = 5 mm).



Figures 10-12. *Neptunea middendorffiana* MacGinitie, 1959. Figure 10. N of Barrow, Alaska (71°15.41 N, 158°38.71 W), 110 m (*leg.* 21 Aug. 2013); Figure 11. NW of Icy Cape, Alaska (70°59.64 N, 165°25.67 W), 41 m (*leg.* 13 Sept. 2012); Figure 12. NW of Wainwright, Alaska (70°59.6 N, 160°52.38 W), 45 m (*leg.* 23 Aug. 2012) (bars = 1 cm). **Figures 13-14.** *Neptunea heros* (Gray, 1850). N of Cape Lisburne, Alaska (69°59.75 N 165°35.15 W), 40 m (*leg.* 26 Aug. 2012) (bars = 1 cm). **Figures 15-16.** *Neptunea ventricosa* (Gmelin, 1790). Barrow, Alaska (71°07.86 N, 158°30.43 W), 50 m (*leg.* 22 Aug. 2013) (bars = 1 cm). **Figures 17.** *Neptunea middendorffiana* MacGinitie, 1959, egg capsules. Peard Bay, NE of Point Franklin, Alaska (71°04.15 N, 158°26.28), 26 m (*leg.* 22 Aug. 2013) (bar = 1 cm). **Figure 18.** *Neptunea heros* (Gray, 1850), egg capsules. NE of little Diomede Island, Alaska (66°30.63 N, 168°30.04 W), 49 m (*leg.* 12 Aug. 2012) (bar = 1 cm). **Figure 19.** *Neptunea ventricosa* (Gmelin, 1790), egg capsules. NE of little Diomede Island, Alaska (66°30.63 N, 168°30.04 W), 49 m (*leg.* 12 Aug. 2012) (bar = 1 cm).

ISSN 0738-9388



Figures 20-22. *Anomalosipho rodgersi* (Gould, 1860). Figure 20. Holotype, *Volutopsius callorhinus* Dall, 1877, USNM 271711, Saint Paul Island, Pribilof Islands, Alaska (57°10 N, 170°20 W), beach drift; Figure 21. Lectotype *Buccinum rodgersi* Gould, 1860, MCZ 169338, Bering Strait (66° N, 169° W); Figure 22. Bering Strait, NE of Little Diomede Island (60°01.07 N, 168°29.73 W), 50 m (*leg.* 12 Aug. 2012) (bars = 1 cm). **Figures 23-24.** *Colus sabini* (Gray, 1824). N of Barrow, Alaska (71°43.25 N, 159°49.06 W), 71 m (*leg.* 24 Aug. 2013) (bars = 1 cm). Figure 24. Living animal with parasitic anemone *Allantactis parasitica* Danielssen, 1890 on shell. **Figures 25-26.** *Plicifusus johanseni* Dall, 1919. Figure 25. WNW of Cape Krusenstern, Alaska (67°30.39 N, 165°52.23 W), 38 m (*leg.* 17 Aug. 2012), ventral. Figure 26. N of Cape Lisburne (72°30.61 N, 166°50.26 W), 48 m (*leg.* 10 Sept. 2012), dorsal (bars = 1 cm). **Figure 27.** *Plicifusus kroeyeri* (Möller, 1842). N of Cape Lisburne, Alaska (70°01.42 N, 167°00.35 W), 47 (*leg.* 2 Sept. 2012) (bar = 1 cm). **Figure 28.** *Buccinum obsoletum* Golikov, 1980, egg capule "tree". Barrow Canyon, N of Barrow, Alaska (71°21.99 N, 158°51.62), 110 m (*leg.* 16 Sept. 2011) (bar = 1 cm). **Figures 29-30.** *Buccinum spp.* egg masses, typical of *Buccinum scalariforme* Møller, 1842 & *Buccinum plectrum* Stimpson, 1865), N of Cape Lisburne (71°29.83 N, 166°56.2 W), 48 m (*leg.* 13 Sept. 2012), and *Buccinum glaciale* Linnaeus, 1761, Figure 30. Over-laid on a mound of *B. scalariforme* eggs, N of Point Franklin, Alaska (71°00.57 N, 159°00.24 W), 45 m (*leg.* 24 Aug. 2012) (bars = 1 cm).

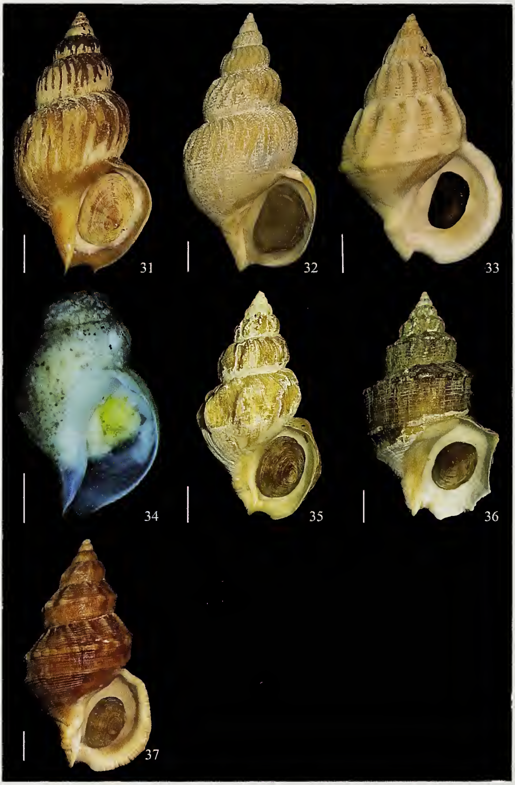


Figure 31. *Buccinum scalariforme* Møller, 1842. N of Cape Lisburne (71°29.83 N, 166°56.2 W), 48 m (*leg.* 13 Sept. 2012) (bar = 1 cm). **Figure 32.** *Buccinum plectrum* Stimpson, 1865). N of Cape Lisburne (71°29.83 N, 166°56.2 W), 48 m (*leg.* 13 Sept. 2012) (bar = 1 cm). **Figure 33.** *Buccinum glaciale* Linnaeus, 1761. N of Point Franklin, Alaska (71°00.57 N, 159°00.24 W), 45 m (*leg.* 24 Aug. 2012) (bar = 1 cm). **Figures 34-35.** *Buccinum obsoletum* Golikov, 1980. Figure 34. Sub-hatchling. Barrow Canyon, N of Barrow, Alaska (71°21.99 N, 158°51.62), 110 m (*leg.* 16 Sept. 2011) (bar = 1 mm). Figure 35. NW of Point Lay, Alaska (71°00.39 N, 163°51.54 W), 43 m (*leg.* 4 Sept. 2012) (bar = 1 cm). **Figure 36.** *Buccinum beringense* Golikov, 1980. NW of Cape Lisburne, Alaska (70°29.57 N, 168°29.42 W) 36 m (*leg.* 15 Sept. 2012) (bar = 1 cm). **Figure 37.** *Buccinum moerchianum* (Dunker, 1858). Petersburg, Wrangell Narrows, Mitkof Island, Alaska (56°48 N, 132°58 W), 1 m (*leg.* 27 Aug. 1992).

ISSN 0738-9388

A Review of the *Haliotis* of Yemen and Oman with Description of a New Species, *Haliotis arabiensis*, from Oman and United Arab Emirates

Buzz Owen [1] Wilco Regter [2] & Kirsten Van Laethem [3]

[1] P.O. Box 601, Gualala, CA 95445, USA
buzabman@mcn.org
[2] Tongelaer 109, 2181 LW Hillegom, Netherlands
wilco-regter@hotmail.com
[3] Heistraat 77, 9100 Sint-Niklaas B, Belgium
bozzelbubbels@gmail.com

ABSTRACT A new species, *Haliotis arabiensis* from Oman and United Arab Emirates is described and illustrated with a high resolution photo plate. Three taxa found along the southern and eastern Arabian Peninsula, two in Oman and the United Arab Emirates, *Haliotis mariae* W. Wood, 1828, and *Haliotis unilateralis* Lamarck, 1822, and one in Yemen, *Haliotis rugosa multiperforata* Reeve, 1846, are reviewed and compared with the new species. Three additional plates illustrate the other southern and eastern Arabian Peninsula *Haliotis*. A fifth plate provides a differential diagnosis of the four taxa.

INTRODUCTION The abalones (Haliotidae) are a family of marine vetigastropods that until recently included 74 taxa (species and subspecies). Many of the subspecies considered valid species prior to a recent reappraisal in Geiger & Owen (2012) were later subsumed into existing species. Currently, the family consists of 55 extant species, with three species currently known from the southern and eastern Arabian Peninsula: *Haliotis mariae*, *H. unilateralis*, and a subspecies of *H. rugosa*, *H. rugosa multiperforata* (Geiger & Owen, 2012; Owen, 2014; Owen & Pan, 2016). Only one of these species, *H. mariae*, is abundant, large in size, and is the subject of an important commercial fishery industry in Oman (Al-Rashdi & Iwao, 2008). *Haliotis unilateralis* is a small, uncommon, but widespread species in the Western Indian Ocean, including the Red Sea and Gulf of Oman (Geiger & Owen, 2012). *Haliotis rugosa multiperforata* is an endemic subspecies of *H. rugosa* restricted to the Hadhramaut and Mahrah coasts of Yemen (Owen & Pan, 2016). *Haliotis rugosa multiperforata* was formerly considered *H. pustulata* Reeve, 1846, and later *Haliotis rugosa pustulata*, but based on comparisons with *H. rugosa pustulata*, *H. rugosa rugosa*, and *H. rugosa rodriguensis*, the taxon from Yemen differed markedly and was given a new subspecific designation (Ali *et al.*, 2009; Geiger & Owen, 2012; Owen, 2013; Owen & Pan, 2016.) Based on these taxa, the southern Arabian Peninsula shows a remarkable amount of species richness in terms of its abalone fauna, particularly for a tropical marine realm in a restricted geographic area. Here we describe a new species of *Haliotis* which is endemic to the southeastern Arabian Peninsula (Oman and United Arab Emirates) that until recently was interpreted as juveniles of *Haliotis mariae*.

Abbreviations of Collections: BOC: Buzz Owen Collection, Gualala, California, USA; NMNZ: Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand; WRC: Wilco Regter Collection, Hillegom, Netherlands; KVLC: Kirsten Van Laethem Collection, Sint-Niklaas, Belgium; RKC: Robert Kershaw

ISSN 0738-9388

Collection, Narooma, New South Wales, Australia; ARC: Arjay Raffety Collection, Marina del Rey, California, USA; CASIZ: California Academy of Sciences, Invertebrate Zoology, San Francisco, California, USA. All shells BOC unless otherwise indicated on Figures.

Shells examined: *H. arabiensis* n. sp., N. Salalah, Oman, to Dibba area of N. Fujairah, United Arab Emirates, 38; *H. mariae*, S. Oman, >500; *H. unilateralis,* Red Sea to Mozambique, >50; *H. unilateralis*, South Oman to United Arab Emirates, 3; *H. rugosa multiperforata*, Broom to Nishtun, Yemen, 26.

Genus *Haliotis* Linnaeus, 1758

Type species. *Haliotis asinina* Linnaeus, 1758 (subsequent designation Montfort, 1810)

***Haliotis arabiensis* Owen, Regter & Van Laethem, new species.**

Type material: Holotype: NMNZ M.319015 (Figure 1.1-2), 25.1 mm. Paratypes: BOC 0952 (Figure 1.4-5), 27.5 mm; WRC 0951 (Figure 1.3), 22.5 mm, from type locality.

Additional specimens: Figure 1.6-7 BOC; Figure 1.8 RKC; Figure 1.9-12 BOC; Figure 5.1 BOC; Figure 5.2 RKC; Figure 5.3 BOC. All Type locality. Figure 1.13 ARC; Figure 1.14-15 BOC; Figure 5.5 ARC; Figure 5.4,6 BOC. All N. Fujairah, United Arab Emirates.

Type locality: North Salalah, South Oman: 17^0 01'97"N, $54^0$08'97" E.

Etymology: The species is named after the Arabian Peninsula where all specimens were found.

Distribution and Habitat: All specimens live-taken by SCUBA diving. Depth 12-18 m. Under rocks and coral. No animals were preserved or studied.

Description (diagnostic characters underlined): Shell small (to ~35-40 mm), medium-weight, oblong, hardly arched, quite flat. Anterior margin slightly curved. Spire somewhat elevated and tilted, located approximately 65% towards posterior margin of shell; visible in ventral view (Figure 1.2, 1.5, 5.3, 5.6). <u>Holes fairly large, elevated, slightly elongate, usually 4, sometimes 5 open.</u> <u>Dorsal surface usually with strong spiral ribbing, cords becoming more pronounced and deeper approaching spire</u>. <u>Periphery between row of holes and columella with 3-4 wide, deep cords in area closest to columella, with one or two weaker and narrower ribs closest to holes. A pronounced ridge separates the two areas.</u> Columella narrow. Color medium to dark red; sometimes greyish purple with scattered whitish patches; occasional specimens almost pure green; may be marked with radial patches of yellowish white sometimes tinged with patches of orange. Specimens from United Arab Emirates are tan to brown marked with white patches. Ventral surface with highly iridescent silver nacre and reflections of green, pink, and steel blue. <u>Usually pronounced strong ribbing and/or lumpiness visible showing through from dorsal surface</u>. No muscle scar.

Comparisons: *Haliotis mariae* (also known locally as Sufailah) (Figure 2) is a larger species that can reach shell sizes in excess of 140 mm, has 5-6 much smaller, slightly elevated, closely spaced holes, and possesses weaker, narrower spiral ribbing, with the spire located closer to the posterior end of the shell (Figure 2). It lacks the strong thick cords in the peripheral area between the holes and columella. In addition, this species differs from *Haliotis arabiensis* in

coloration. The shells of *H. mariae* typically are dark brown with large whitish chevron markings, occasionally having lime green colors as well.

Haliotis unilateralis (Figure 3) is quite flat and generally smooth or has "bumps" often arranged in radial raised areas; very rarely has even weak spiral ribs. The periphery between the holes and columella has a wide rib in center extending well away from shell usually forming a prominent ridge, with 1-3 weaker ribs above and below it. The spire is positioned closer to the center of the shell.

Haliotis rugosa multiperforata (Yemeni specimens were formerly considered *H. rugosa pustulata*) (Figure 4) has 6-8 smaller slightly elevated holes, weaker and narrower spiral ribbing, and is smooth, lacking strong, wide cords in the peripheral area between the holes and columella. It is generally dark brown in color with irregular markings of greenish-white. Red colored specimens have not been observed.

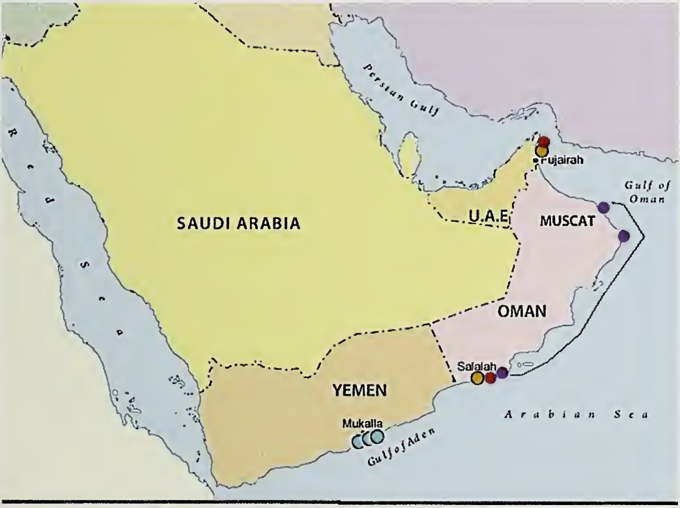


Figure 6 Distribution Map Key

- = *Haliotis arabiensis* n. sp.
- = *Haliotis mariae*
- = *Haliotis unilateralis*
- = *Haliotis rugosa multiperforata*

Remarks. One of the authors (K. Van Laethem) has conducted extensive malacological surveys and collecting of the intertidal and beach communities in Dhofar and adjacent coastal areas of Oman. Amongst the abalone fauna, *Haliotis mariae* are very common, while *H. unilateralis* and *H. arabiensis* are extremely rare (only single specimens of the latter taxa have been collected by K. Van Laethem). No specimens of *Haliotis rugosa* (*H. rugosa multiperforata* or *H. rugosa pustulata*) were found during these collection surveys, and we question whether this very shallow subtidal species is found in Oman (and U.A.E.). The rarity of *H. arabiensis* during these surveys is likely due to their general occurrence at depths of greater than 12 m, with few washing up in the intertidal zone. It is also much less common than *H. mariae* (S. Gori, personal observation). The six specimens from North Fujairah, U.A.E., tend towards a tan to brown coloration, and have none of the bright red, purple, orange or green colors seen in the specimens from the N. Salalah area of Oman.

Note: Figure 2 on Plate 36, pg. 218 of *Abalone Worldwide Haliotidae* (Geiger & Owen, 2012), illustrates a specimen of *H. arabiensis* incorrectly identified as *H. mariae.*

ACKNOWLEDGEMENTS

Aaron Pan, Arjay Raffety and David P. Berschauer provided editorial guidance. Bob Kershaw provided photo images of hatchery produced *H. mariae* and one specimen of *H. arabiensis*. Arjay Raffety provided images of one specimen of *H. arabiensis*.

REFERENCES

Ali-Rashdi, K.M. & T. Iwao. 2008. Abalone, *Haliotis mariae* (Wood, 1828), hatchery and seed production trials in Oman. *Agricultural and Marine Sciences* 13:53-63.

Ali. A. M., A. A. Basmidi, M. Sh. Aideed & Al-Quffail A. Saeed, 2009. First Remarks on Abalone Biology (*Haliotis pustulata*) on the Northern Coast of Aden Gulf, Yemen. *Journal of Fisheries and Aquatic Science*, 4: 210-227.

Bosch, D. & E., 1989. Seashells of Southern Arabia, *Motivate Publishing.*

Bosch, D. T., S.P. Dance, R.G. Molenbeek, & O. P. Graham, 1995. Seashells of Eastern Arabia, *Motivate Publishing,* ISBN: 1873544 64 2.

Geiger, D. L. 1998. Recent Genera and Species of the Family Haliotidae Rafinesque, 1815 (Gastropoda: Vetigastropoda). *The Nautilus* 111:85-116.

Geiger, D. L. 2000. Distribution and Biogeography of the Recent Haliotidae (Gastropoda:Vetigastropoda) World Wide. *Bollettino Malacologico* 35:57-120.

Geiger, D. L. & B. Owen. 2012. Abalone Worldwide Haliotidae. *Conchbooks*, Hackenheim, 361 pp., 92 pls.

Owen, B. 2013. Notes on the correct taxonomic status of *Haliotis rugosa* Lamarck, 1822, and *Haliotis pustulata* Reeve, 1846, with description of a new subspecies from Rodrigues Island, Mascarene Islands, Indian Ocean (Mollusca: Vetigastropoda: Haliotidae). *Zootaxa* 3646 (2): 189-193.

Owen, B. 2014. A new species of *Haliotis* (Gastropoda) from São Tomé & Príncipe Islands, Gulf of Guinea, with comparisons to other *Haliotis* found in the Eastern Atlantic and Mediterranean. *Zootaxa* 3838 (1):113-119.

Owen, B. & A. D. Pan 2016. A Review of the *Haliotis rugosa* Lamarck, 1822, Complex of the Western Indian Ocean, with Notes of the Subspecific Status of *Haliotis multiperforata* Reeve, 1846. *The Festivus* 48(1):33-43.

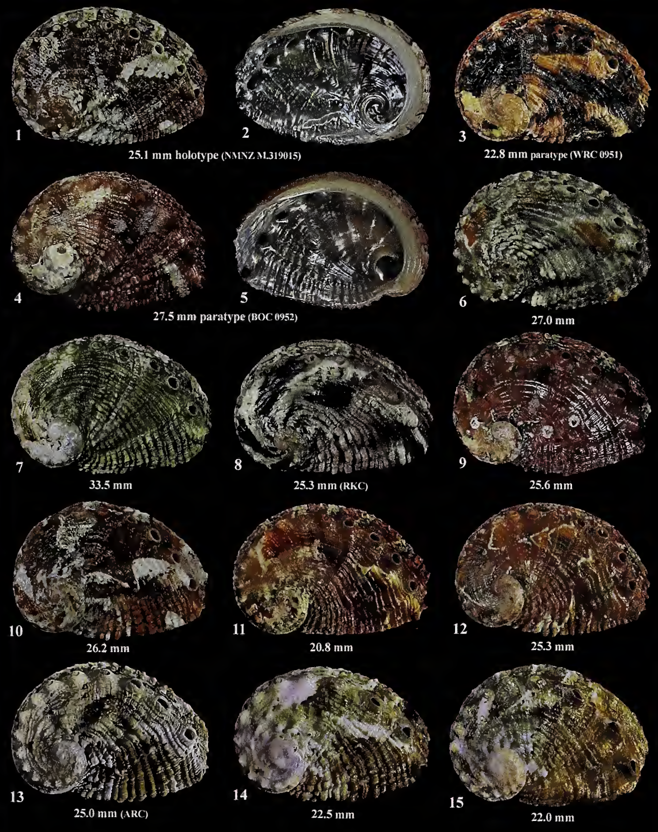


FIGURE 1. *Haliotis arabiensis* n. sp. 1-12. N. Salalah, South Oman. Live-taken 12-18 m by SCUBA diving. 13-15. N. Fujairah, United Arab Emirates. Live-taken 10-15 m by SCUBA diving.

ISSN 0738-9388

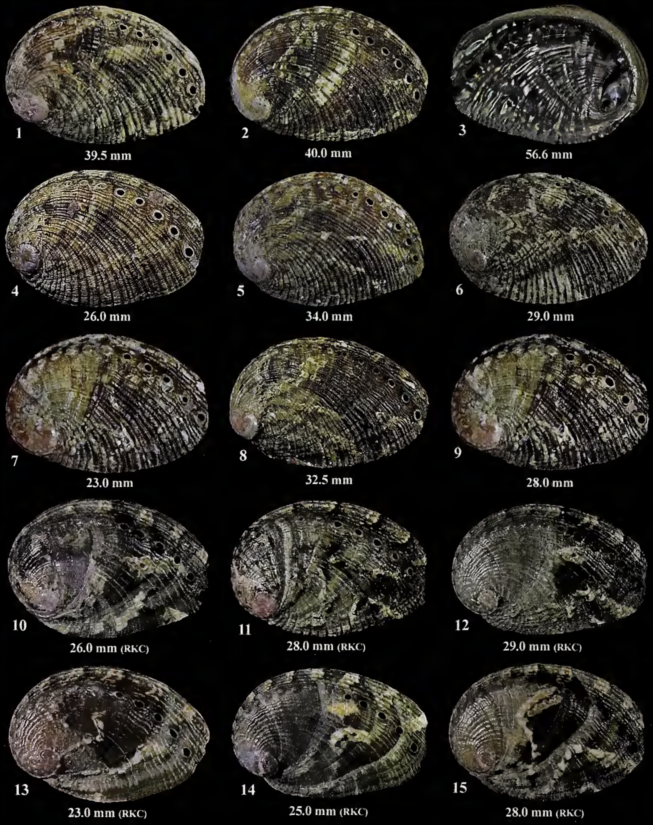


FIGURE 2. *Haliotis mariae.* 1-9. N. Salalah, South Oman. Beach collected from natural populations. 10-15. Hatchery cultured at Mirbat Bay, Oman. 1999-2000.

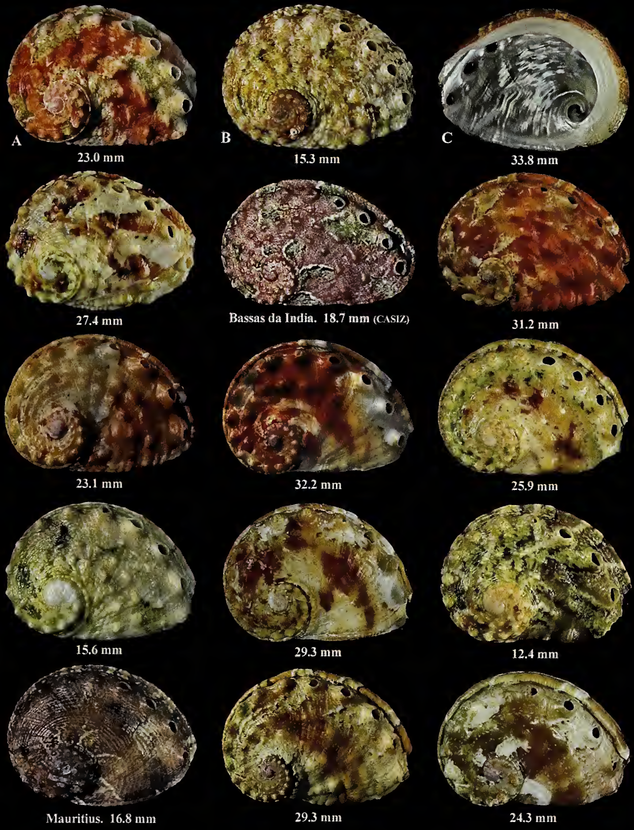


FIGURE 3. *Haliotis unilateralis.* Top Row. A-Mozambique. 10-20 m. B-Fernão Veloso, Mozambique. 10-20 m. C-Red Sea. 15 m. Rows 2-5. Red Sea area, unless marked otherwise. 1-40 m.

ISSN 0738-9388

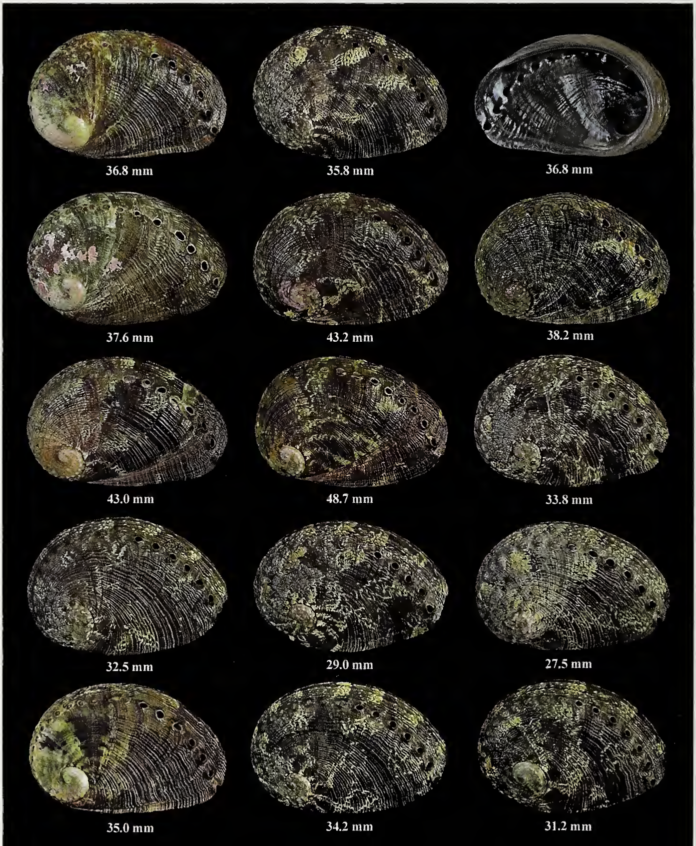


FIGURE 4. ***Haliotis rugosa multiperforata*** **(Reeve, 1846). Broom, 35 km SW of Mukalla, Yemen. Live-taken by snorkeling, 2004-2006. Prior to 2013 known as *H. pustulata* Reeve, 1846 (see *Introduction*).**

ISSN 0738-9388

FIGURE 5. Differential Diagnosis

1-3. *Haliotis arabiensis* n. sp. South Oman. 4-6. *H. arabiensis* n. sp. United Arab Emirates. 7-9. *H. mariae*. South Oman. 10-12. *H. unilateralis*. South Oman. 13-15. *H. rugosa multiperforata*. Broom/Mukalla, Yemen.

ISSN 0738-9388

A New Species of Cone Shell (Gastropoda: Conidae) from the Saharan Coast of Northwestern Africa

Edward J. Petuch [1] and David P. Berschauer [2]
[1] Department of Geosciences, Florida Atlantic University, Boca Raton, Florida 33431
epetuch@fau.edu
[2] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com

ABSTRACT A new species of *Lautoconus* (Conidae: Puncticulinae) is described from the intertidal rocky environments of Dahkla Bay, central Western Sahara. The new species is most similar to *L. guanche* from the Canary Islands, but differs in having a stockier, more darkly-colored, and lower-spired shell. The new species, here named *L. saharicus* n. sp., is endemic to Dahkla Bay and the Dahkla area of Western Sahara, roughly 400 km south of the Canary Islands.

KEY WORDS Cone shell, Conidae, *Lautoconus*, Western Sahara, Northwestern Africa.

INTRODUCTION In June 1974, the senior author visited the coast of northwestern Africa as part of his Masters Degree research on the molluscan biogeography of West Africa. At that time, the coastal region of northwestern Africa, between Morocco and Mauritania, was referred to as "Spanish Sahara" and was essentially uninhabited, containing only a few Spanish Foreign Legion Posts, scattered small coastal fishing villages, and nomads such as the Tuaregs and Sahrawis. In 1975, Spain relinquished its control over Spanish Sahara, after three years of civil war, and the newly-independent country then became known as "Western Sahara". The conflicts have continued on into the present, as Western Sahara subsequently has been claimed, and occupied, by both Morocco and Mauritania. Although often shown on maps as the "Western Sahara District" of Morocco, we will refer to the country as "Western Sahara" in this paper. The local inhabitants now refer to their country as the "Sahrawi Arab Democratic Republic" and are resisting Moroccan rule, making it a dangerous place to visit and collect shells.

The only regularly-accessible city in Western Sahara, both in 1974 and now, is the small coastal town of Dahkla, roughly halfway between Cap Boujdour (Cabo Bojador), Morocco and the tip of Cap Blanc (Cabo Blanco), on the Mauritania-Morocco border (Figure 1). Formerly known as "Villa Cisneros", Dahkla was a Spanish Foreign Legion post when the senior author visited the city in 1974 and it was accessible by airplane, with two flights a week, from Tenerife Island, Canary Islands. The town sits on a narrow peninsula (formerly known as the "Peninsula de Rio de Oro") that separates the North Atlantic Ocean from the large and elongated Dahkla Bay (previously referred to as the "Rio de Oro") and is located in one of the most desolate areas of the Sahara Desert. With almost no rainfall, the area surrounding Dahkla Bay is devoid of any vegetation and closely resembles photographs of the surface of Mars. Being elongate and fjord-like, as in the Bay of Fundy in Nova Scotia, Dahkla Bay has very large tidal fluctuations and vast sand flat areas are exposed during low tide. The shoreline of Dahkla Bay, along the eastern side of the Dahkla Peninsula, is lined with low cliffs that are composed of a

ISSN 0738-9388

thick sandstone surface layer sitting on top of loose desert sand. Wave action has undermined much of this coastline and large blocks of the sandstone have broken off the top of the cliffs and have fallen to the cliff base, producing a large talus area that extends all around the bay.

Figure 1. Map of Western Sahara region

The vast sand flats and rocky shorelines of Dahkla Bay offer a variety of habitats for intertidal mollusks. Being at the extreme northern edge of the Guinean Molluscan Province (Western Sahara south to southern Angola) and in a relatively cold water area, the molluscan fauna in Dahkla Bay is very impoverished, with only a few species of gastropods being present. The sand flats support a very small fauna of gastropods, but these are present in very large numbers of individuals. Only four species were commonly collected, and these included the cone shell *Kalloconus byssinus* (endemic to Western Sahara and Mauritania), the volutes *Cymbium cymbium* and *C. tritonis*, and the cysticid *Persicula cingulata.* Likewise, the rocky shoreline was equally impoverished, with only three species of gastropods being collected, but again in large numbers of individuals. These included the muricids *Ocinebrina miscowichae* and *Hexaplex canariensis* and a small cone shell in the genus *Lautoconus*. Initially, this distinctive cone was referred to as "*Conus guinaicus*", and was considered to be only a dwarf variant of the much larger and more colorful *L. guinaicus* from the tropical waters of Senegal. Specimens were donated to the Smithsonian Institution and this interesting cone shell was relegated to a foot note in the senior author's field notebook.

Cone shells similar to the Western Sahara *Lautoconus* were also known to inhabit the eastern Canary Islands, and for years these were also incorrectly relegated to the taxon "*Conus guinaicus*". Lauer (1993) demonstrated that the Canary Islands cone was not "*C. guinaicus*" but was, actually, a new and separate species which he named "*Conus*" *guanche* (for the Guanches, the original inhabitants of the Canary Islands; Lauer, 1993). In the same paper, he also described a color form or variety *nitens*, which has been found on some of the eastern islands of the archipelago. Because of superficial similarities in shell shape, size, and color, most cone workers have used the taxon *guanche* for the Western Saharan species. This taxonomic assignment is untenable, especially when considering that *L. guanche* has a paucispiral protoconch and non-planktonic larvae with limited dispersal abilities, and that the Dahkla Bay area is over 400 km south of the southernmost islands of the Canary Archipelago, contains a completely different type of molluscan fauna (tropical-subtropical), and belongs to a different biogeographical faunal region (the Guinean Molluscan Province). Upon closer examination of recently-collected specimens from Dahkla, purchased from Rika Goethaels and Fernand De Donder of Belgium, we found that the Western Saharan cone shell exhibits consistent differences when compared

to the Canarian *L. guanche* and represents a previously-overlooked unnamed species. This new cone is described in the following sections.

SYSTEMATICS

Class Gastropoda
Subclass Orthogastropoda
Superorder Caenogastropoda
Order Sorbeoconcha
Infraorder Neogastropoda
Superfamily Conoidea
Family Conidae
Subfamily Puncticulinae
Genus *Lautoconus* Monterosato, 1923

***Lautoconus saharicus* Petuch and Berschauer, new species**
(Figures 2 A, B, and C)

Description: Shell of average size for genus, stocky, inflated, bulbous, only slightly glossy, with matte finish; shoulder broad, rounded, only slightly angled; spire low, broadly pyramidal; body whorl smooth and silky, with 20-24 very fine, low, closely-packed spiral threads around anterior end; body whorl base color dark sky blue or deep bluish-green, overlaid with numerous large, dark brown amorphous flammules, generally evenly-spaced and arranged in zebra-like pattern; brown flammules often composed of 3 sections, being broader and wider along edge of the shoulder, around midbody, and around anterior end, creating effect of 3 broken spiral bands of flammules; spire whorls base color dark sky blue, heavily marked with thick, evenly-spaced dark brown crescent-shaped flammules, producing distinctive checkered appearance; aperture proportionally-wide and flaring, colored deep purple-brown on the interior; inner edge of lip colored pale yellow-white; purple-brown interior marked with single narrow white band just anterior of mid-body line; periostracum thin, pale yellow, transparent.

Type Material: HOLOTYPE- length 27.4 mm, LACM 3333; PARATYPE- length 22.6 mm, LACM 3334; Other material examined includes 5 specimens in the David Berschauer collection, 30.2 mm, 25.6 mm, 21.7 mm, 19.8 mm (Figure 2C), and 16.5 mm, and two specimens, lengths 28.1 mm and 25.8 mm in the research collection of E.J. Petuch, all from the same locality and depth as holotype. Two more specimens, collected by senior author in 1974, are currently un-cataloged and in general cone collection of United States National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Type Locality: Dahkla (formerly Villa Cisneros), western side of Dahkla Bay, Western Sahara (formerly Spanish Sahara), western coast of Sahara Desert, northwestern Africa. Types collected under large slabs of sandstone, at base of low cliffs along eastern side of Dahkla Peninsula (western side of Dahkla Bay), at low tide.

Range: Endemic to Dahkla Peninsula (Peninsula de Rio de Oro) and Dahkla Bay, Western Sahara.

Ecology: *Lautoconus saharicus* is restricted to quiet, sheltered intertidal areas in Dahkla Bay, where it occurs cryptically under large slabs of sandstone along the shoreline. Co-occurs with two muricid gastropods, *Hexaplex canariensis* and *Ocinebrina miscowichae*, and numerous small oysters and barnacles.

Etymology: Named for the Sahara Desert, which is adjacent to, and surrounds, the type locality.

ISSN 0738-9388

Discussion: Of the known Mediterranean and West African *Lautoconus* species, *L. saharicus* is most similar to the Canary Islands endemic *L. guanche* (Lauer, 1993) (Figure 2 D) but consistently differs in the following ways:

1. *L. saharicus* has an inflated, compact, and stocky body whorl, while *L. guanche* has a proportionally longer, more protracted, and fusiform body whorl;

2. *L. saharicus* is proportionally much broader across the shoulder than *L. guanche*;

3. *L. saharicus* has a more rounded and distinctly less-angled shoulder than *L. guanche*;

4. *L. saharicus* has a much lower, almost flattened spire, while *L. guanche* has a much higher, more elevated, and protracted spire with distinctly more sloping and angled spire whorls;

5. *L. saharicus* is a more brightly-colored shell, with a base color of dark blue or bluish-green, overlaid with irregular dark brown longitudinal flammules, often arranged in a zebra pattern, and covered with amorphous dark brown speckling; *L. guanche* is a more lightly-colored shell, having a pale blue or blue-gray base color that is overlaid with widely-scattered light khaki or tan amorphous flammules;

6. the interior of the aperture of *L. saharicus* is consistently a dark purplish-brown color, while the interior of the aperture of *L. guanche* is always a light tan-brown color;

7. the spiral threads around the anterior end of *L. saharicus* are much finer and more numerous than the coarser spiral threads and small cords around the anterior end of *L. guanche*;

8. the spire whorls of *L. saharicus* are marked with proportionally-large, evenly-spaced wide dark brown flammules, producing a distinctive checkered appearance; the spire whorls of *L. guanche* are marked with only thin, irregularly-spaced pale tan flammules, often with large colorless gaps.

Lautoconus saharicus is the only cone shell that lives in the calm water, sheltered rocky intertidal areas of Dahkla Bay, where it often occurs in large numbers under slabs of sandstone. This Western Sahara endemic is part of an impoverished, but highly endemic, molluscan fauna that is restricted to the Sahara Desert coastline in a stretch ranging from Cabo Bojador to Cabo Blanco. Other important Western Saharan endemics include the muricids *Ocinebrina purpuroidea* and *Jaton hemitripterus*, both of which occur in the rocky intertidal areas on exposed coastlines with stronger wave action. These characteristic Saharan species, along with the endemic muricid *O. miscowichae* and the endemic cone shell *Kalloconus byssinus*, are not found on the Canary Islands, demonstrating that there is a substantial ecological and biogeographical barrier between the Dahkla area and the Canary Islands. *Lautoconus guanche*, itself, has limited dispersive ability, as it is present only on the eastern Canary Islands of Fuerteventura, Lanzarote, Gran Canaria, and Tenerife, but is absent from the western Canary Islands of La Palma, El Hierro, and Gomera (Munoz Sanchez, 2014). If this Canary Islands endemic is unable to disperse throughout one-half of its resident archipelago, then it would be even more difficult to extend its range southward over 400 km to the Dahkla Bay area. The morphological similarities of *L. guanche* and *L. saharicus*, then, appear to be exclusive sister taxa which may have evolved from a common more widespread ancestor.

A recent paper by Cunha, *et al.*, 2014 studied the *L. guanche* and *L. guanche nitens* populations in the Canary Islands, and Tarfaya on the adjacent mainland, primarily utilizing DNA sequence data from two mitochondrial alleles (NADH4 and 16s RNA) and one nuclear allele (ITS1). Radular tooth morphology and a geometric morphometric analysis were also undertaken, and the analysis of these data led to the authors' conclusion in that paper that, in

spite of the observed phenotypic differences, all the individual specimens studied belonged to one single species (Cunha, *et al.*, 2014). Molecular studies such as this are the result of the modern trend of "DNA bar-coding", which embodies what has been referred to by cone expert John Tucker as "molecular hubris" (personal communication). Such studies fail to meet the requirement of total evidence for several reasons: they focus primarily on mitochondrial DNA (rather than the organism's autosomal DNA); they fail to select sufficient nuclear alleles from the thousands of genes in the subject organism for meaningful study; and, most importantly, they are based upon the unstated assumption that natural selection operates at the level of individual nucleotides rather than at higher organizational levels. (Fitzhugh, 2006; Fitzhugh, 2016; Thompson, *et al.*, 2014). The purpose of both multivariate statistical analysis and Bayesian analysis is to indicate correlations which are presumed to explain the variability observed in natural populations of organisms; when these analyses do not indicate correlations that are presumed to explain that variability, it can only be interpreted that the correct data was not included in the study.

The senior author extensively explored and surveyed the molluscan fauna of western Africa and Spanish Sahara and no *Lautoconus* individuals similar to *L. saharicus* were found between Tarfaya and Dahkla Bay. It should be noted that *L. saharicus* is found in a completely different habitat than that of the Mediterranean and Canary Islands *Lautoconus* species, and that it co-exists with a completely different molluscan fauna that belongs to a different biogeographical province. In the case of *L. saharicus,* all the morphology, biogeography, ecology, geological history, and oceanography points to *L. saharicus* being a separate species. It is likely that *L. guanche nitens* is also a distinctive subspecies that is restricted to the eastern Canary Islands, particularly Lanzarote and Fuerteventura. Therefore, even within the Canary Archipelago, true *L. guanche* does not range very far, demonstrating that these cones have non-planktonic larvae and probably are direct developers with limited dispersal abilities.

The genus *Lautoconus* is now known to contain 22 valid species and ranges from the eastern Mediterranean Sea to the Canary Islands, and southward along the African coast to Gambia. Of these known species, 15 are endemic to the Cape Verde Peninsula region of Senegal and represent one of the largest conid species radiations known from West Africa. We recognize the following species as valid taxa:

MEDITERRANEAN SEA (Mediterranean Molluscan Province)

Lautoconus desidiosus (A. Adams, 1854)
Lautoconus vayssieri (Pallary, 1906)
Lautoconus ventricosus (Gmelin, 1791)

CANARY ISLANDS (Canarian Subprovince of the Mediterranean Province)

Lautoconus guanche (Lauer, 1993)
Lautoconus guanche nitens (Lauer, 1993)

WESTERN SAHARA (West Saharan Subprovince, Guinean Province)

Lautoconus saharicus Petuch and Berschauer, new species

SENEGAL (Senegalian Subprovince, Guinean Province)

Lautoconus belairensis (Pin and Tack, 1989)
Lautoconus bruguieresi (Kiener, 1845)
Lautoconus cacao (Ferrario, 1983)
Lautoconus cloveri (Walls, 1978)
Lautoconus dorotheae (Monnier and Limpalaer, 2010)
Lautoconus echinophilus (Petuch, 1975)

ISSN 0738-9388

Lautoconus franciscanus (Hwass, 1792) (= *unifasciatus*)
Lautoconus guinaiacus (Hwass, 1792)
Lautoconus hybridus (Kiener, 1845)
Lautoconus lamarcki (Kiener, 1845)
Lautoconus mercator (Linnaeus, 1758)
Lautoconus pineaui (Pin and Tack, 1995)
Lautoconus tacomae (Boyer and Pelorce, 2009)
Lautoconus taslei (Kiener, 1845)
Lautoconus trencarti (Nolf and Verstraeten, 2008)

GAMBIA (Senegalian Subprovince, Guinean Province)
Lautoconus orri (Ninomiya and daMotta, 1982)

Future research, particularly in the Mediterranean Sea, will doubtlessly demonstrate that several more valid and previously-overlooked *Lautoconus* species exist.

ACKNOWLEDGMENTS

We thank Rika Goethaels and Fernand De Donder, Peutie-Vilvoorde, Belgium, for the generous donation of extra specimens of *Lautoconus saharicus*. Special thanks to Mark Roth, formerly of the University of Wisconsin-Milwaukee, for accompanying the senior author to West Africa and assisting in collecting specimens of this new species.

REFERENCES

R. Cunha, F. Lima, M.J. Tenorio, A.A. Ramos, R. Castilho, and S. Williams. 2014. Evolution at a Different Pace: Distinctive Phylogenetic Patterns of Cone Snails from Two Ancient Oceanic Archipelagos. *Systematic Biology* 63(6):971-987.

K. Fitzhugh. 2006. DNA Barcoding: An Instance of Technology-driven science? BioScience 56(6):374-375.

K. Fitzhugh. 2016. Sequence Data, Phylogenetic Inference, and Implications of Downward Causation. Acta Biotheor. 2016 Mar 9, 2016. (E-publication ahead of print)

Lauer, J. 1993. Description of a new species and subspecies of *Conus* (Mollusca: Prosobranchia: Conidae) from the Canary Islands. *Apex* 8 (1/2): 37-50, 14 figures.

Munoz Sanchez, B.J. 2014. A personal experience: Searching for West African cones off the eastern coast of Gran Canaria, Canary Islands. *The Cone Collector* (24): 42-47 (www.theconecollector.com: online e-magazine)

Thompson, R.C., D.C. Plachetzki., D.L. Mahler, and B.R. Moore. 2014. A critical appraisal of the use of microRNA data in phylogenetics. Proceedings of the National Academy of Science, July 28, 2014, doi: 10.1073/pnas.1407207111

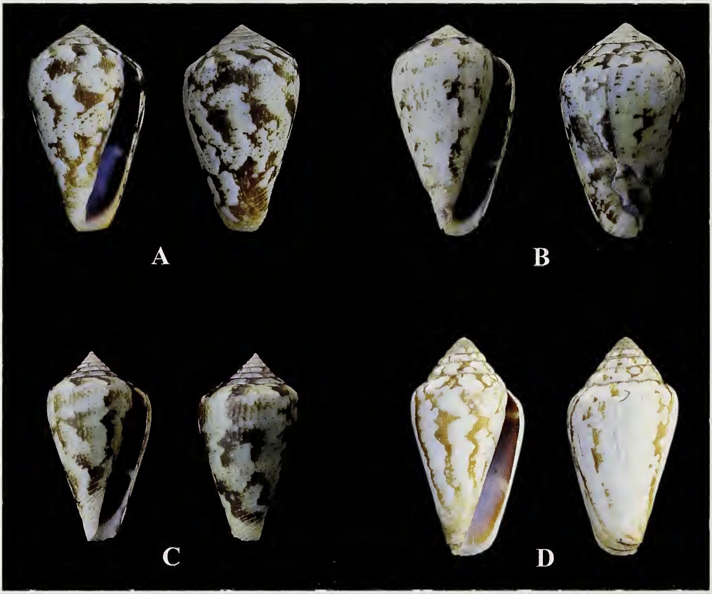


Figure 2. A = *Lautoconus saharicus* n. sp., Holotype, length 27.4 mm, LACM 3333, Dakhla Bay, Western Sahara; B = *L. saharicus* n. sp., Paratype, length 22.6 mm, LACM 3334; C = *L. saharicus* n. sp., length 19.8 mm, Berschauer Collection; D = *L. guanche*, length 29.1 mm, Santa Cruz de Tenerife, Tenerife Is., Canary Islands, Berschauer Collection.

ISSN 0738-9388

Letter to the editor regarding "Commercially driven taxonomy: The necessity of knowing species; by Stephen J. Maxwell and Tasmin L. Rymer"

John K. Tucker
Illinois Natural History Survey-retired
Rantoul, Illinois 61866
johnktucker@gtec.com

I read the Maxwell and Rymer article (2016, Festivus 48(1):52-53) with interest and agree with many of the conclusions. However, some important points are omitted. I have been accused of 'taxonomic inflation' myself. When Manuel Tenorio and I wrote our book *Systematic Classification of Recent and Fossil Conoidean Gastropods* (2009, ConchBooks, 269 pp., 11 pls.) we recognized 5 families with 4 subfamilies containing 89 genera of which 27 were newly described from what had widely been considered to be a single genus and family. We used cladistic methods to attempt to clarify clades among these taxa in an as objective way as possible to differentiate and define these genera. Our analysis departed from all other supraspecific classifications in that we did not exclude fossil taxa and that we relied heavily on the morphology of the conoidean radula. The radula among cone shells had been widely ignored or dismissed as taxonomically useless with no attempt to determine homologies among the radular traits. This problem is still common and one only has to examine Kohn's new Western Atlantic book (A. J. Kohn, 2014, *Conus of the Southeastern United States and the Caribbean*, Princeton University Press, 457 pp), which continued using imprecise definitions of radular morphological traits. Our radular traits along with shell traits produced phylogenetic trees similar in many respects to those produced from molecular studies. Some of our critics have accused us of taxonomic inflation. We consider this spurious considering that cone shells had essentially been included in a single family with a single genus. Such a system was and still is widely put forward as a *good enough* explanation for 80 million years of worldwide evolution. It might have been easier to use a single family single genus classification. Unfortunately, such an approach is not scientifically useful. Moreover, the single genus placed into a single family classification contains almost no information, which is the only reason to have a supraspecific classification to begin with. For instance, the old taxonomy of Conidae/*Conus* information content is all concentrated in the family name. A Conidae will have the conical coiling of the shell; the resorption of the inner shell walls; they will be predators that use a specialized radular tooth as a venom delivery apparatus, etc. However, the generic name is meaningless. It can carry only the information already transmitted by the family name. In contrast, the Tucker & Tenorio classification, has a family name (*e.g.*, Conilithidae), a subfamily name (*e.g.*, Conilithinae), and a genus name (*e.g.*, *Jaspidiconus*). In this instance, the family and subfamily names carry the same sort of information that the name Conidae carries. However, these suprageneric names also carry specific information on the radular tooth. Conilthidae and Conilithinae have radular teeth that do not have serrations but their teeth do all have a shaft fold. The genus name, *Jaspidiconus* transmits certain shell and radular morphological traits. All of the *Jaspidiconus* have whorl tops that do not have cords; all have paucispiral protoconchs; none have an anterior

ISSN 0738-9388

notch; the radular teeth have posterior and anterior folds, all have a basal spur, *etc.* In this classification, the generic names are not meaningless because they transmit systematic information unique to *Jaspidiconus*. We thus did not think that use of all the generic names was a simple example of inflation. We also tried to define each taxon in an objective way; one of Maxwell & Rymer's goals.

Regardless, Maxwell and Rymer (2016) suggested four reasons for what they identified as taxonomic inflation. Assuming that they define taxonomic inflation as an increasing number of taxa at various levels, they miss the most obvious reason for increasing numbers of taxa. That reason is scientific progress often due to new discoveries in new places not just the tendency for commercial interests to play the *name game*. A good example would be the species swarm found in the Cape Verde Islands. When Jerry Walls (1979: *Cone Shells*, TFH Publications, 1011 pp.) wrote his book on cone shells, there were only about eight species of cone shells described between 1843 and 1975 listed by Walls as endemic to the Cape Verde Islands. Since 1975, a further 83 species group taxa (all *Africonus* species) have been described as endemic to the Cape Verde Islands. In part, this number may reflect some inflation but mostly it does not. It is instead due to the exploration of the diverse habitats in the Cape Verde Islands by European collectors. These *Africonus* species do not have long larval dispersive phases, which apparently results in the geographically isolated cone shell species (*see* Monteiro *et al.*, 2004, *A Conchological Iconography. The family Conidae. The West African and Mediterranean species of Conus*, ConchBooks, 102 pp., 164 pls.). Another example, no doubt, will be the deep water species just now being pulled from the vicinity of New Caledonia by deep dredging operations. These species largely escape commercial effects because almost all are being collected by museum expeditions and being described by museum professionals.

I do agree that descriptions of new species by shell dealers are likely to prove to be bad ideas. Here there is a strong likelihood of conflict of interest. Not a certainty, but certainly a likelihood. When I complain about these possible conflicts to other collectors, the ghosts of the Sowerbys are often raised as good justification for continuing a bad practice. Be that as it may, the ICZN has nothing to say about the practice and the names are usually technically valid anyway. In fact, the various suggestions about judging the quality of descriptions by the professional level of the describers or having a group of defined journal or defined academics that are allowed to describe new species is foolishness and would not reduce the number of new species being described. Our system of ICZN rules now in use is good and does not get in the way of scientific inquiry.

Finally, I doubt that taxonomic inflation, at least among cone shells, is that bad of a problem. Moreover, can it be objectively defined well enough to show that it is an actual problem? For example Dr. Edward Petuch and his coauthors have described about 175 Holocene species or subspecies of cone shells. Many of the West Atlantic species belong to the genera *Purpuriconus* or *Jaspidiconus*, both of which do not have strong dispersive abilities. Of the *Purpuriconus,* Alan Kohn (2014) considered 12 of Petuch's species to be synonyms of *P. cardinalis*. So on one hand, one author may have inflated the number of *Purpuriconus* whereas another deflated them, *i.e.*, the old lumper versus splitter conundrum. Similar to *Jaspidiconus* (*see* Tucker, 2015, Festivus 47(4):250-254) there is no way to independently decide just how many species of *Purpuriconus*

ISSN 0738-9388

or *Jaspidiconus* are valid. We just do not yet know how to distinguish the little red cones (*Purpuriconus*) from each other. We know nothing about how reproductive isolation works in cone shells. It is possible that molecular methods may help but that remains to be seen. However, before molecular methods can be used on a large scale it is necessary to provide names to the samples that are going to be compared. I think my advice to collectors of cone shells is: "Don't worry, be happy" (from the 1988 song by Bobby McFerrin; and that olive shells are even worse).

Figure 1 consists of various specimens from the Purpuriconus cardinalis complex. They are listed as forms but many likely represent full species and Tucker & Tenorio (2013) should be consulted for details. Many other morphs were not included among these but they are in Tucker & Tenorio (2013).

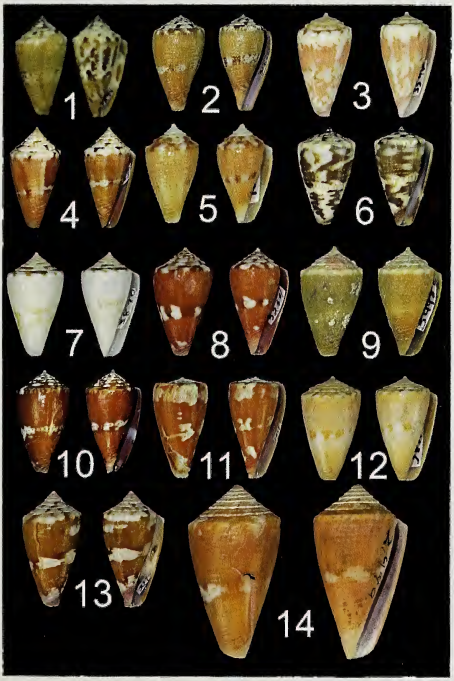


Figure 1.
1. INHS 80076, form *abbotti*, 28.3 mm long, in 2 to 3 m under coral rocks, Winding Bay, Eleuthera, Bahamas. 2. INHS 44792 form *belizeanus*, 24.6 mm long, 3 to 5 m, under rocks, off Southeast Cay, Belize. 3. INHS 44905 form *bessei*, 16.5 mm long, Catasarca Key, Honduras. 4. INHS 79996 *cardinalis* (form *rosalindensis*), 20.2 mm long, in 30 m, Isla de San Andreas, Colombia. 5. INHS 44968 form *donnae*, 13.9 mm long, in 3 to 6 m, Andros Island, Bahamas. 6. INHS 44940 form *explorator*, 17 mm long, in 24 m, north coast of Jamaica. 7. INHS 44939 form *hennequini*, 18.5 mm long, in 2 m, La Vauclin, Martinique. 8. INHS 80074 form *lucaya*, 31.7 mm long, in 1 to 3 m, Abaco Cays, Bahamas. 9. INHS 44883 form *magellanicus*, 16.1 mm long, in 18 m, northwest point, Providenciales, Turks and Caicos Islands. 10. INHS 45017 form *pseudocardinalis*, 21.2 mm long, in 50 to 65 m off Guarapari, Espirito Santo, Brazil. 11. INHS 44817 form *richardbinghami*, 36.1 mm long, in 20 m, off Victory Cays, SW Bahama Bank, Bahamas. 12. INHS 44911 form *sahlbergi*, 17.3 mm long, in 10.7 m, south Cat Cay, Bahamas. 13. INHS 44818 form *sphacelatus*, 31.7 mm long, in 1.5 to 3 m, Abaco Cays, Bahamas. 14. INHS 44755 form *stanfieldi*, 18.9 mm long, off Fort Myers, Florida (from an old collection). Specimen is shown at a greater magnification because it is the only *Purpuriconus* in INHS collections with a Florida locality data. There are sufficient carbonaceous habitats off shore along the Gulf of Mexico that a species of *Purpuriconus* could occur there.

ISSN 0738-9388

A New Species of *Harpa* (Gastropoda: Harpidae) from the Coral Sea Archipelagos of Queensland, Australia

David P. Berschauer [1] and Edward J. Petuch [2]

[1] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com
[2] Department of Geosciences, Florida Atlantic University, Boca Raton, Florida 33431
epetuch@fau.edu

ABSTRACT A new species of *Harpa*, closely related to the widespread Indo-Pacific *Harpa major* Röding, 1798, is described from the Coral Sea archipelagos east of the Great Barrier Reef system of Queensland, Australia. The new taxon, *Harpa queenslandica*, differs from *Harpa major* in being consistently a smaller and more lightweight shell, in having fewer varices per whorl, in having a much paler shell color, and in having a proportionally-larger protoconch that is composed of 3 ½ whorls.

KEY WORDS *Harpa*, Harpidae, Coral Sea, Queensland, Australia.

INTRODUCTION The shallow water (0-20 m) areas along the Swain Reefs (Mackay/Capricorn Management Area) and the central Great Barrier Reef (Townsville/Whitsunday Management Area) of southern Queensland State, Australia, have long been known to house an unusually-rich molluscan fauna with a high level of endemism. The coral reef complexes of this region are renowned for containing an exceptionally-large and remarkable species radiation of the volutid genus *Cymbiola (Cymbiolacca)* (with at least 20 species and subspecies), unusual cypraeid subspecies such as *Cribrarula cribraria melwardi*, *Naria labrolineata maccullochi*, and *Bistolida brevirostris fluctuans*, and distinctive cone shells such as *Lividiconus biliosus imperator* and the newly-described *Tesselliconus devorsinei*. The high levels of biodiversity and endemism along the southern and central reef complexes demonstrate that these areas, collectively, represent one of the primary "hot spots" of evolution within the Coral Sea Basin.

Farther offshore of the Great Barrier Reef, on the shallow continental shelf that extends eastward into the Coral Sea, lies a large archipelago of coral cays, atolls, and shallow carbonate banks, containing at least 25 major island groups. Of these, only the Diamond Islets and Lihou Reef, on the far eastern edge of the continental shelf, have been regularly visited and explored by divers and collectors. These remote coral atolls were found to house a number of seldom-seen and rare endemic gastropods, with the beautiful striped volute *Cymbiola (Cymbiolacca) perplicata* being the single most sought-after collector's item. While searching for this desirable volute on Diamond Islets, Lihou Reef, and off Swain Reefs, a small, very pale or white harp shell (genus *Harpa*) was also encountered in the same habitat that was inhabited by *C. perplicata*. This unusual harp shell was first brought to attention by a well known Queensland molluscan adventurer Doug Thorn, who was trawling these remote region for the elusive *C. perplicata*. Bret Raines and Kim Hutsell were on one of these early

expeditions with Doug Thorn in 1999, and collected specimens of this unique small white *Harpa*. Shortly thereafter, Bret Raines wrote an article about this unique *Harpa* in the American Conchologist (Raines, 2000). Years later, the authors became aware of this interesting *Harpa* and began seeking out further information from Richard Goldberg, Bret Raines, Kim Hutsell, and Doug Thorn. With the generous assistance of members of the Cairns Shell Club, and others, the authors were able to obtain photographs and specimens of a substantial number of specimens. Upon closer examination, this pale-colored harpid was found to represent a new, previously-unrecognized species of *Harpa* closely related to the widespread Indo-Pacific *Harpa major* Roding, 1798. This new endemic Queensland harpid species is described here.

SYSTEMATICS

Class Gastropoda
Subclass Orthogastropoda
Order Sorbeoconcha
Suborder Caenogastropoda
Infraorder Neogastropoda
Superfamily Volutoidea
Family Harpidae
Genus *Harpa* Roding, 1798

Harpa queenslandica Berschauer and Petuch, new species
(Figures 1, 2A-F, 3A, 3C, 3E)

Description: Shell small for genus and consistently much smaller than nominate subspecies, averaging 30-50 mm in length; shell thin, lightweight, highly inflated, broadly bulliform; spire low, with broadly sloping whorls; shoulder rounded; body whorl ornamented with 12-18 thin, widely-separated, evenly-spaced axial ribs; facing edge of ribs highly polished, shiny; edge of shoulder ornamented with row of small, sharp spines, with each spine corresponding to an axial rib; areas between ribs heavily ornamented with distinctive reticulated sculpture pattern composed of very numerous intersecting fine axial and radial threads; aperture wide and flaring, broadly oval in shape; columellar area with broad, shiny, adherent parietal shield; shell base color pure white, overlaid with widely-scattered pale pinkish-tan zig-zag or triangular flammules; ribs pure white, marked with 4 broad, pale pink or pinkish-tan bands, one below shoulder, one on each side of mid-body line, and one around anterior end; pink bands often marked with reddish-brown or dark tan linear flammules or bars, outlining the edge of each band; anterior half of parietal shield marked with large, prominent dark brown patch; posterior end of parietal shield marked with smaller, pale brown or tan patch; interior of aperture pure white; protoconch proportionally very large, dark tan-gold in color, composed of 3 ½ whorls.

Figure 1. Holotype of *Harpa queenslandica* 34.5 mm, dredged at 10m off East Diamond Islet, Australia, in 1999.

Type Material: HOLOTYPE: length 34.5 mm, width 23.6 mm, QMNH as number QM MO84636 (in the type collection of the Queensland Museum of Natural History, Brisbane, Australia: Figure 2C); OTHER SPECIMENS EXAMINED: length 30.2, 35.8, 50.9, and 52.9 mm (Figures 2A, D, E, and F) Berschauer Collection ; length 34.1 mm (Figure 2B) Petuch Collection.

Type Locality: The holotype was dredged from between 15 and 20 m depth, northeast of Swain Reef, southern Great Barrier Reef, Queensland, Australia.

Range: At present, the new species is known only from the western Coral Sea, from the areas off Swain Reef, and the coral atolls of Lihou Reef and the Diamond Islets.

Ecology: *Harpa queenslandica* occurs on clean carbonate sand substrates near beds of coral rubble, at depths of 10-25 m within the Neritic Zone of the Coral Sea archipelagos east of the Great Barrier Reef. Here it occurs with other volutoideans such as *Cymbiola (Cymbiolacca) perplicata* and *Miniaceoliva lamberti*.

Etymology: Named for the Australian State of Queensland, to which the new subspecies is endemic.

Discussion: The new taxon represents an isolated species of *Harpa* closely related to the widespread Indo-Pacific *Harpa major* Roding, 1798, that is restricted to the western Coral Sea area and may coexist with *H. major* there. The senior author has been advised that *Harpa queenslandica* and *H. major* coexist in limited areas in the Cairnes region. (Tassey Weinreich, personal communication.) *Harpa queenslandica* (Figures 2A-F) differs from *H. major* in being much paler colored (almost pure white), in being a much thinner and more lightweight shell, in having a smaller adult size, and in having a characteristic microsculpture pattern on the body whorl in the areas between the ribs. This microsculpture (Figure 3C) is composed of very numerous fine, evenly-spaced axial threads that intersect with numerous fine spiral threads, producing a distinctive dense reticulated pattern. These reticulations are especially prominent on subadult specimens (Figures 2A, 2B, 3A, and 3C) but become over-glazed and more subdued in fully mature specimens (Figure 3A). As shown on Figure 3E, the protoconch of *H. queenslandica* is also proportionally-larger and better-developed than that of *H. major*, being composed of 3 ½ whorls as opposed to 3 whorls. This large protoconch size correlates with the limited geographical range of the new species, indicating that the animal has direct development and a non-planktonic larva, resulting in a very limited ability to disperse.

Typical *Harpa major* (Figure 3B) is a much larger and heavier shell than *queenslandica*, and has a base shell color of a deep pinkish-rose or reddish-tan, overlaid with white zig-zag flammules. The ribs of *H. queenslandica* are pure white with a few bands of pale tan and scattered reddish-brown lines, while those of *H. major* are a deep rose-tan overlaid with thin white stripes and dark brown lines. While having an intracostal sculpture pattern composed of thin longitudinal threads, subadult and adult specimens of *H. major* never exhibit the reticulated intracostal sculpture seen on *H. queenslandica*. The authors have also examined several photographs which show the shells and living animal of *H. queenslandica* and compared and contrasted it to similar photos of the shell and living animal of *H. harpa*. The body and foot of *H. queenslandica* is white with a pattern of tan bloches, and the siphon is tan with white splotches and the eye stalk tentacles are striped white and tan. By comparison the body and foot of *H. harpa* is a medium brown

with a pattern of yellow spots and a few white splotches, and the siphon is a darker brown with light brown splotches and the eye stalk tentacles are striped dark brown and light brown. A photograph of the shell and living animal of *H. queenslandica* is shown in Figure 4.

A geographically-isolated subspecies of *H. major* was recently described from the Marquesas Islands of easternmost French Polynesia. This new taxon, *H. major ivojardai* Cossignani, 2013, is substantially more similar to *H. major* than *H. queenslandica* and shares the same type of dark coloration and shell thickness with *H. major*, but has much more heavily-sculptured intracostal areas than *H. major*. The discovery of this Marquesan endemic subspecies, along with the new Queensland species, demonstrates that at least two populations of *H. major* have become sufficiently genetically-isolated to have become sibling species.

AKNOWLEDGMENTS

The authors extend their thanks to Richard Goldberg, Kim Hutsell, Doug Thorn, Malcolm Ford, Thierry Vulliet, and Jom Patamakanthin, for sharing information about this fascinating small white *Harpa*. Special thanks go out to Cairnes Shell Club members Trevor Young, Stephen Maxwell, Valda Cantamessa, Anne Butler, and to John Boyle for assistance in obtaining specimens and for detailed photographs and measurements of other specimens for study. Dr. John Healy of the Queensland Museum provided information and photographs of other *Harpa* specimens in his museum's collection for comparison. Giorgio Strano provided English translations of Tiziano Cossignani's recent *Harpa* articles from the original Italian. We also extend our sincere appreciation to Tassey Weinreich for allowing us to use his gorgeous photograph of the live animal of *Harpa queenslandica* in this paper.

REFERENCES

Cossignani, T. 2013. A new Harpa from the Marquesas Islands. Malacologia 81:4.
Raines, B. 2000. A Trip to Remember. American Conchologist. 28(1): 6.

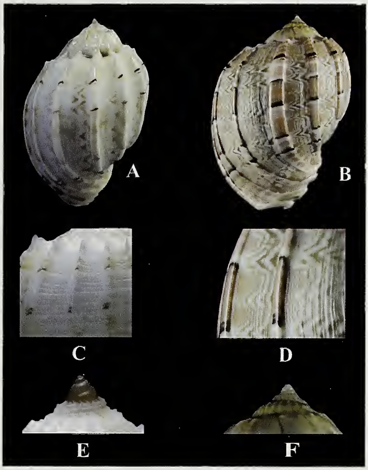


Figure 3. A = *Harpa queenslandica* 67.3 mm, collected diving at 15m off Lihou Reef, Australia in July 2006 by Ron Moylan, in the Trevor Young Collection; B = *Harpa major* 69.9 mm in length, collected off Samar Island, Philippines, from the Berschauer Collection; C = Macroscopic photo of the microsculpture of *H. queenslandica* (from Figure 2A); D = Macroscopic photo of the microsculpture of *H. major* (from Figure 3B); E = Macroscopic photo of the protoconch of *H. queenslandica* (from Figure 2A); F = Macroscopic photo of the protoconch of *H. major* (from Figure 3B).

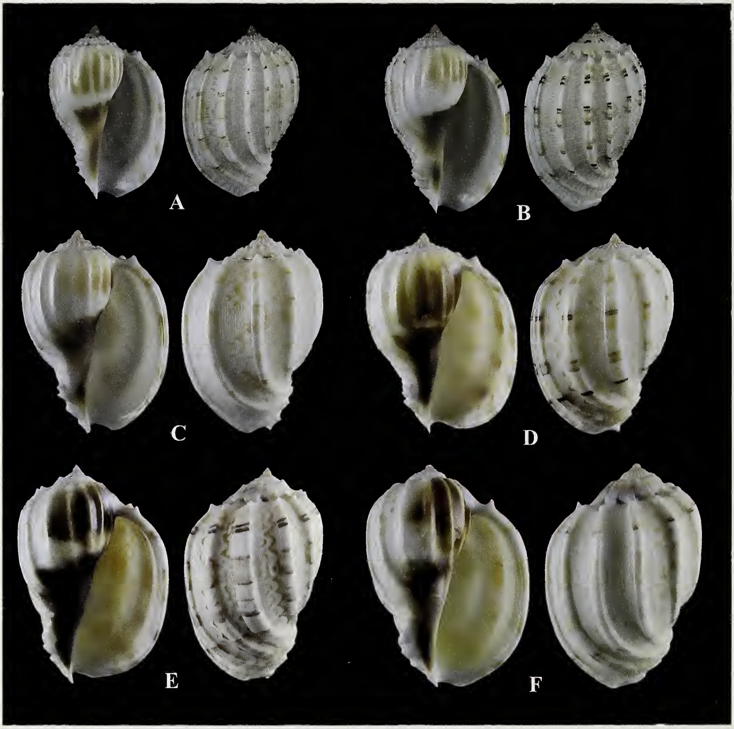


Figure 2. A = *Harpa queenslandica* 30.2 mm in length, dredged in deep water off Swain Reef, Australia by Remy Devorsine and Thierry Vullet in 2014, in the Berschauer Collection; B = *H. queenslandica* 34.1 mm in length, dredged in deep water off Swain Reef, Australia by Remy Devorsine and Thierry Vullet in 2014, in the Petuch Collection; C = Holotype of *H. queenslandica* 34.6 mm in length, dredged at 10 m in coral sand off East Diamond Islet, Australia by Malcolm Ford in 1999, in the type collection of the Queensland Museum of Natural History, Brisbane, Australia, as number QM MO84636; D = *H. queenslandica* 50.9 mm in length, collected by scuba diving at 10-15 m off East Diamond Islet by Doug Thorn in 1999, in the Berschauer Collection; E = *H. queenslandica* 51.2 mm in length, dredged at 15 m off Lihou Reef, Australia by Doug Thorn in 1999, in the Berschauer Collection; F = *H. queenslandica* 51.9 mm in length, dredged at 15m off Swain Reef, Australia by Doug Thorn in 1999, in the Berschauer Collection..

ISSN 0738-9388

Figure 4. Live specimen of *Harpa queenslandica*, approximately 70 mm in length, collected in 2008 in the Cairns Region, Australia and photographed by Tassey Weinreich. Photo used with written permission of Tassey Weinreich; all rights reserved.

Editor's Note: *The Festivus* is accepting articles for future issues. Articles of a scientific nature may be submitted for the peer reviewed portion of our journal. Please refer to our Guidelines for Authors, and/or Guidelines for the Description of New Taxa in *The Festivus*, both available on our website: http://www.sandiegoshellclub.com/festivus/ Articles are subject to a blind peer review process, and submission of an article does not guarantee acceptance or publication. We also accept articles of general interest to malacologists, conchologists and shell collectors for publication in the general interest section of our journal. All articles must be accompanied by either the author's original artwork, or a signed copyright waiver from the copyright holder.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 2

Camaena abbasi, a new species (Gastropda: Camaenidae) from Indonesia

Nguyen Ngoc Thach
Former Research Associate, Oceanographic Institute
Nha Trang, Vietnam
267 Thong Nhat Street, Nha Trang, Vietnam
kurodashvietnam@yahoo.com

ABSTRACT A new species of the genus *Camaena* Albers, 1850 is described from Popidolong, South East Peleng Island, East Sulawesi, Indonesia and is compared to four other species of this genus: *Camaena gabriella* f. *subhainenensis* (Pilsbry, 1890); *Camaena gabriellae* var. *platytaenia* Dautzenberg & Fischer, 1908; *Camaena duporti* (Bavay & Dautzenberg, 1900); and *Camaena sakishimana* Kuroda, 1960. It is characterized by a slightly flat base with a concave umbilical area and not reflected outer lip.

KEYWORDS Gastropoda, Helicoidea, Camaenidae, *Camaena*, Popidolong, South East Peleng island, East Sulawesi, Indonesia, new taxon.

INTRODUCTION The genus *Camaena* Albers, 1850 belongs to the family Camaenidae and many species of this family are native to Indonesia. In July of 2008, a new camaenid was found that was not listed in the works by Dharma (2005), Parkinson *et al.* (1987), Abbott (1989) and Stanisic *et al.* (2010). It is here described as new to science.

Abbreviations:

ANSP	Academy of Natural Sciences of Drexel University, Philadelphia, USA
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NNT	Collection Dr Thach
RMNH	Rotterdam Museum of Natural History
JA	Collection John Abbas
AL	Aperture length
SH	Shell height
SW	Shell width

SYSTEMATICS

Class Gastropda Cuvier, 1797
Superfamily Helicoidea Rafinesque, 1815
Family Camaenidae Pilsbry, 1895
Genus *Camaena* Albers, 1850
Type species: *Helix cicatricosa* Müller, 1774, subsequent designation by Martens in Albers, 1860

***Camaena abbasi* n. sp.**
Figures 1-8

Description:
Shell medium-sized for the genus (33-35mm in average adult width), heliciform, dextral, and longer in width than in height, 65.6% shell width, see Table 1 with measurements on five specimens. Spire with variable heights, sutures impressed. Body whorl moderately inflated, periphery with a narrow spiral keel. Sculpture consisting of numerous closely-spaced axial riblets. Aperture semilunate with a length 53.8% of the shell width, outer lip slightly thick, usually angulate and not reflected. Base slightly flat and weakly sculptured, umbilicus small

open but partly covered by columella. Color variable (yellowish, whitish, brown or black) with white spiral band at suture and periphery.

Type material:
Holotype 35.3 mm wide in ANSP (Figs.1,2). Paratypes: all from type locality, Paratype 1: 34.6 mm wide in MNHN (Fig.3,4), Paratype 2: 34.7 mm wide in JA (Fig.6,7), Paratype 3: 32.9 mm wide in NNT (Fig.5), Paratype 4: 34.6 mm wide in JA (No 8).

Type locality:
Popidolong, South East Peleng island, East Sulawesi, Indonesia.

Range and habitat:
The type specimens were collected on vine thickets and known only from type locality.

Etymology:
This new species is named in honor of Mr. John Abbas of Hawaii (USA) for providing the type material that he collected on Peleng Island.

DISCUSSION

• *Camaena abbasi* n.sp. is close to *Camaena gabriella* f. *subhainenensis* (Pilsbry, 1890) (Figure 12) but differing in less inflated whorls, smaller adult size, slightly flat base, not reflected outer lip and presence of a narrow keel at the periphery.

• *Camaena abbasi* differs mainly from *Camaena gabriellae* var. *platytaenia* Dautzenberg & Fisher, 1908 (Figures 9, 11a) in less swollen body whorl, smaller adult size, smoother exterior surface, slightly flat base, not reflected outer lip, presence of a narrow spiral keel and white (not dark brown) spiral band at the periphery.

• *Camaena abbasi* differs mainly from *Camaena duporti* (Bavay & Dautzenberg, 1900) (Figure 11b) in much smaller umbilicus, less inflated body whorl, not reflected and much thinner outer lip and presence of a narrow spiral keel at the periphery.

Table 1. Mean SH/SW and AL/SW of *Camaena abbasi* n.sp.

Specimen	SW (mm)	SH (mm)	SH/SW	Mean SH/SW	AL (mm)	AL/SW	Mean AL/SW
1	35.3	23.0	0.652	0.656 (65.6%)	18.4	0.521	0.538 (53.8%)
2	34.6	21.0	0.607		19.3	0.558	
3	34.7	21.3	0.614		18.9	0.545	
4	32.9	22.0	0.669		17.6	0.535	
5	34.6	25.6	0.740		18.3	0.529	

ISSN 0738-9388

• *Camaena abbasi* differs mainly from *Camaena sakishimana* Kuroda, 1960 (Figure 10) in larger adult size, slightly flat base, much smaller umbilicus, not sharply angulate periphery, not calloused outer lip and an opaque aperture.

ACKNOWLEDGEMENTS

I want to thank the Natural History Museum of Rotterdam for use of the photo of *Camaena duporti*, Guido & Philippe Poppe for use of the photo of *Camaena gabriella* f. *subhainenensis*, and the Bishogai Data Base for use of the photo of *Camaena sakishimana*. Thanks are also due to the reviewers for useful comments.

REFERENCES

Abbott, R.T. 1989. Compendium of landshells. American Malacologists Inc., Florida, USA, 240 pp.

Dharma, B. 2005. Recent & Fossil Shells of Indonesia. ConchBooks, Hackenheim, Germany, 432pp.

Parkinson, B., J. Hemmen & K. Groh. 1987. Tropical land shells of the world. Verlag Christa Hemmen, Wiesbaden, Germany, 279 pp.

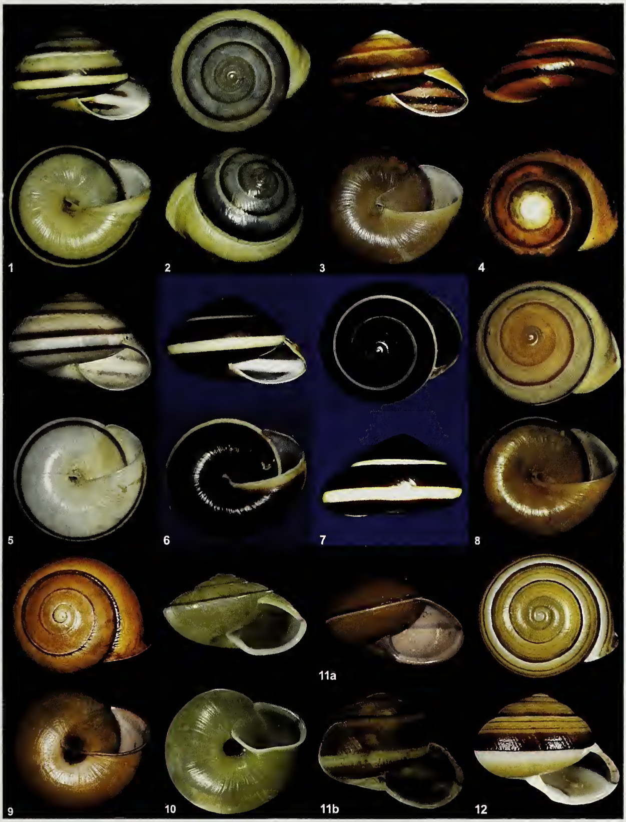
Stanisic,J., M. Shea, D. Potter & O. Griffiths. 2010. Australian Land Snails, Volume 1. Bioculture Press, Mauritius, 591pp.

Website of Bishogai Data Base http://bigai.world.coocan.jp/pic_book/

Website of Rotterdam Museum of Natural History http://www.nmr-pics.nl/

Website of Philippe & Guido Poppe http://www.conchology.be/

ISSN 0738-9388



Figures 1-8: ***Camaena abbasi*** n.sp., Peleng Island, Indonesia - **1,2**: Holotype 35.3 mm, ANSP- **3,4**,: Paratype 1: 34.6 mm, MNHN- **5**: Paratype 3, 32.9 mm, NNT- **6,7**: Paratype 2: 34.7mm, JA- **8**: Paratype 4: 34.6mm, JA- **9,11a**: ***Camaena gabriellae*** var. ***platytaenia*** Dautzenberg &Fisher,1908, 37.5 mm- **10**: ***Camaena sakishimana*** Kuroda, 1960, 17mm photo of Bishogai Data Base- **11b**: ***Camaena duporti*** Bavay&Dautzenberg,1908, 52 mm, photo of Rotterdam Museum of Natural History- **12**: ***Camaena gabriella*** f. ***subhainenensis*** (Pilsbry,1890) 36.9 mm, photo of P. &G.Poppe, 2014.

ISSN 0738-9388

New species of *Amphidromus* (*Syndromus*) from northern Meratus Mountains, Kalimantan

Jeff Parsons BAppSc, BSc (Hons)
47 Elizabeth Street, Aitkenvale, Queensland, Australia 4814
jeffonese@yahoo.com.au

ABSTRACT This paper describes a new member of the *Amphidromus* (*Syndromus*) *adamsii* (Reeve in Adams, 1848) group from Mount Sarempakang on the border of South and East Kalimantan, Indonesia. A comparison is made with other members of the *A.* (*S.*) *adamsii* group, and with extraterritorial species in the groups of *A.* (*S.*) *contrarius* (Müller, 1774) and *A.* (*S.*) *sinistralis* (Reeve, 1849). *A.* (*S.*) *stevenliei* new species is distinguishable from other members of the *A.* (*S.*) *adamsii* group based on shell and animal morphology, and conchologically separable from other congeners.

KEY WORDS *Amphidromus*, *Syndromus*, *stevenliei*, Mount Sarempakang, Borneo, Kalimantan.

INTRODUCTION Species belonging to the group of *Amphidromus* (*Syndromus*) *adamsii* (Reeve in Adams, 1848) have some of the most varied and brightly coloured shells of the whole genus *Amphidromus* Albers, 1850. Fulton first conceived the group in 1896 whilst naming variations of *A.* (*S.*) *adamsii*, and grouped them with similar established and new taxa from southern Palawan, islands of the Palawan Passage, Borneo and northern satellite islands. In 1900 whilst partially rearranging Fulton's groupings, Pilsbry modified the status of some taxa and added five species to the *A.* (*S.*) *adamsii* group. Laidlaw and Solem (1961) removed four of those species from the group and changed the status of the fifth and other taxa. Until more material becomes available for study, a modified version of what Laidlaw and Solem proposed is used, which includes one recently named species, *A.* (*S.*) *thalassochromus* (Vermueulen & Junau, 2007).

Mid 2014, Steven Lie sent me several photos of a live *Amphidromus* snail he received from his contacts in South Kalimantan and asked me to identify it. This snail is from Mount Sarempakang, on the border of South and East Kalimantan ('Sarempaka' in fig. 1). A lack of published photos of living *Amphidromus* snails meant its identification had to wait until Steven sent me a photo of an empty shell. A study of Bornean *Amphidromus* found three other species with similar comet-like blotches on the lower whorls: *A.* (*S.*) *angulatus* (Fulton, 1896), *A.* (*S.*) *coeruleus* (Clench & Archer, 1932) and *A.* (*S.*) *thalassochromus*. Very small, degraded or reduced comet-like blotches, and similar periostracum and/or parietal tubercles are found on shells of *A.* (*S.*) *quadrasi* (Hidalgo, 1887) and its subspecies [*A.* (*S.*) *adamsii* group], and extraterritorial species in the groups of *A.* (*S.*) *contrarius* (Müller, 1774) and *A.* (*S.*) *sinistralis* (Reeve, 1849). However, those congeners are all conchologically separable from the new species. The Mount Sarempakang snail is distinguishable from other members of the *A.* (*S.*) *adamsii* group based on shell and animal morphology, and described herein as *A.* (*S.*) *stevenliei* new species.

ISSN 0738-9388

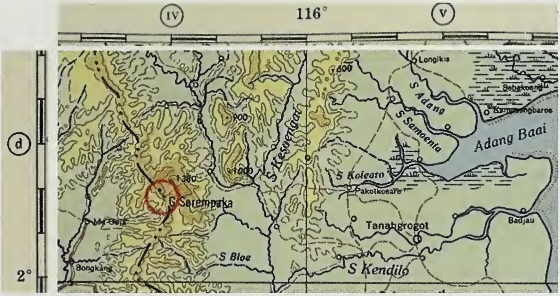


Figure 1. Location map for *Amphidromus* (*Syndromus*) *stevenliei* new species. The red circle indicates the approximate position of the type locality. Modified from a map of "Bandjermasin, Borneo" (University of Texas Libraries, 2015)

Materials and Methods

Type material has been deposited in the Natural History Museum, London, England, UK and Muséum National d'Histoire Naturelle, Paris, France; and additional types are found in the private collections of Steven Lie, John Abbas and the author. Preserved anatomical material was unavailable for study. Instead, a comparison was made of living animals of the new and related species using digital images from Steven Lie, Bornean Terrestrial Molluscs website (Liew, 2011) and anonymous sources. The species description was determined from shell morphology of dry empty shells supplied by Steven Lie and John Abbas. Comparative material comprised of shells from my own private collection and images of type shells published by Sutcharit *et al.* (2015).

Shells were measured using digital Vernier callipers (0.01 mm resolution). Shell height, aperture length and shell width include the reflected outer lip for adult shells. The parameter 'umbilical size' reflects a shell's umbilicus may be roundly open or rimate. Relative shell sizes for the subgenus *Syndromus* mentioned are as follows: small < 30 mm, medium 30-45 mm and large > 45 mm. Whorl count includes the apex as per Haniel (1921, p. 22, fig. 10) and counted precise to 0.125 (⅛ whorl). The aperture length was measured along the long axis as per Haniel (1921, p. 10, fig. 2). Shell weight was measured in grams (g) using a pocket-sized electronic scale (capacity 300 g x 0.01 g).

Shell sculpture was examined under low magnification (10x) using a jeweller's loupe. All but one of the shells examined had formed an outer lip: 15 adults (four damaged with the apex or protoconch missing, a dent or a hole) with a thickened lip, 3 subadults with broken thin lips and one brown juvenile without a lip. Colours are described as per the nomenclature of Ridgway (1912) or common English (Geddes & Grosset, 2007), and hyphenation follows that of the 'Style Manual' (U.S. Government Printing Office, 2008). 'Paries' (adj. parietal) refers to the 'inner apertural wall'. 'Palatum' (adj. palatal) refers to the interior surface of the labrum (outer lip) or 'outer apertural wall'.

Taxonomic remarks

According to Petit (2007), the correct "author and date" citation for *A.* (*S.*) *adamsii* is (Reeve in Adams, 1848). See Petit's work for his justification. I here accept *A.* (*S.*) *quadrasi dubius* (Fulton, 1896), *A.* (*S.*) *q. everetti* (Fulton, 1896), *A.* (*S.*) *q. solidus* (Fulton, 1896), *A.* (*S.*) *q. versicolor* (Fulton, 1896) and *A.* (*S.*) *q. palawanensis* (Bartsch, 1928) all as valid subspecies until confirmed otherwise. The *A.* (*S.*) *contrarius* group includes *A.* (*S.*) *contrarius*, *A.* (*S.*) *reflexilabris* (Schepman, 1892) and *A.* (*S.*) *laevus* (Müller, 1774) as per Severns (2006). The *A.* (*S.*) *sinistralis* group contains the species as stated by Laidlaw and Solem (1961).

Abbreviations used for museums and private collections:

NHMUK = Natural History Museum, London, England, UK
MNHN = Muséum national d'Histoire naturelle, Paris, France
SL = Steven Lie collection
JA = John Abbas collection
JP = Jeff Parsons collection

Abbreviations for shell morphometry:

A = aperture length
A/H = aperture length/shell height ratio
D = shell width (the abbreviation aligns with the usage of 'diameter' in the literature)
H = shell height
H/D = shell height/shell width ratio
N = whorl count
W = shell weight
U = umbilical size

SYSTEMATIC DESCRIPTION

Class Gastropoda Cuvier, 1795
Family Camaenidae Pilsbry, 1895
Genus *Amphidromus* Albers, 1850
Subgenus *Syndromus* Pilsbry, 1900

***Amphidromus* (*Syndromus*) *stevenliei* new species**
(Figures 2–5)

Type Material: 12 adult shells (11 yellow and 1 flesh-coloured) and 1 juvenile (brown).

Holotype (Figure 2): NHMUK 20150004/1
Holotype measurements: H 38.00 mm, D 20.37 mm, H/D 1.87, A 19.06, A/H 0.50, N 6.50, U 0 mm and W 0.72 g

Paratypes (12 shells): NHMUK 20150004/2 (1 yellow shell); MNHN IM-2012-36212 (1 yellow shell); SL (1 yellow shell); JA (1 yellow shell); JP (8 shells - 6 yellow adults, including 2 damaged by a dent or a hole; 1 brown juvenile and 1 flesh-coloured adult)

Paratype measurements: H 31.35-38.04 (av. 34.68) mm, D 16.50-21.24 (av. 19.59) mm, H/D 1.63-2.01 (av. 1.77), A 14.98-19.08 (av. 17.39), A/H 0.48-0.54 (av. 0.50), N 6.25-6.875 (av. 6.50), U - (round) 0-0.89 (av. 0.43) mm, U - (rimate) 0.41 x 0.21 to 1.50 x 0.31 (av. 0.89 x 0.42) mm and W 0.59-1.60 (av. 0.91) g

Type locality: Mount Sarempakang, northern Meratus Mountains, border of South and East Kalimantan, Indonesia (Figure 1).

Distribution: currently known only from the type locality.

Habitat: found on the leaves and trunks of various small trees (about 2 m high) and bananas in mixed dipterocarp and submontane forest, collected by locals for Steven Lie.

ISSN 0738-9388

Animal: body yellowish grey with a wide, blackish mid-dorsal stripe, all sprinkled with lemon granules, paler on the flanks; ocular and sensory tentacles yellowish grey at the base grading to pale orange-brown and yellow ochre respectively; foot and tail pale grey with paler granules; sole cream and mantle pale grey to very pale flesh-coloured (Figure 3).

Soft Parts: still under investigation.

Etymology: named in honour of Mr. Steven Lie from Sumatra, Indonesia, who is new to the hobby of snail collecting and the first person to bring this snail to my attention.

Other Material Examined: 6 yellow shells examined from the type locality (JP); 3 subadult shells with damaged very thin reflected lips and 3 damaged adult shells – apex missing in one, protoconch missing in another, plus one with depigmented areas and increased shell transparency.

Shell measurements (6 shells): H 29.13-40.00 (av. 32.47) mm, D 17.83-20.75 (av. 18.80) mm, H/D 1.63-1.68 (av. 1.66), A 15.16-18.56 (av. 16.85), A/H 0.46-0.54 (av. 0.51), N 6.125-7.00 (av. 6.50), U - (round) 0 mm (1 shell), U - (rimate) 0.57 x 0.26 to 1.13 x 0.42 (av. 0.75 x 0.26) mm and W 0.42-0.78 (av. 0.54) g.

Figure 2. *Amphidromus* (*Syndromus*) *stevenliei* n. sp., holotype NHMUK 20150004/1.

DESCRIPTION

Shell medium sized, sinistral, relatively solid and ovate-conic. Spire subturreted, moderately long. Surface rather shiny; *protoconch* minutely pitted (punctulate); *teleoconch* marked with collabral growth threads and lines, occasional ridgelets on the last two whorls and microthreads (crowded apically); plus spirally directed short ridgelets, grains and/or obsolete striae. Whorls rather convex, gradually expanding; last whorl not inflated, not descending in front and base gently rounded; periphery obsoletely, subangularly rounded. Suture impressed apically, appressed below. Periostracum pale green-yellow.

Protoconch 1½ whorls, flesh tinted; rotund and subtranslucent. Apex blunt, barely exsert; subopaque, whitish. Transition to the teleoconch

distinguished by a change in sutural angle. Teleoconch pale flesh tinted grading to pale lemon, base darker. Early whorls have greyish streaks and an obsolescent, flesh-tinted supraperipheral band. Infrasutural fillet cream apically, white below. Last three whorls with scattered, clustered or obliquely aligned comet-like blotches. Markings initiated by a subtransparent, grey spot (> 0.5 mm) or dot (< 0.5 mm), sometimes with a lemon subcentral speck; and attached to a faint, whitish adapertural streak. Spots and dots are round or oval, 0.1-0.8 mm wide or long; streaks slightly narrower, 1-2.75 mm long. Last whorl has a wide and obsolescent, purple basal band on the paries and a narrow and ghostly, greyish peripheral band, visible only in transmitted light. Circumumbilical band pale magenta, narrow.

Aperture oblique, auriform. Palatum covered in a dull-lemon film, clearly showing the external markings. Parietal callus faintly calcified, colourless and imperceptible. Outer lip very glossy, vivid magenta, thickened and somewhat flared; edge flat, strongly reflected and narrowly expanded. Preapertural band pale greyish cream; lip termination slightly ascending. Outer lip may also be purplish magenta and fades to brownish pink after death. Columella glossy, vivid magenta, narrow and a little twisted; oblique and abaperturally angled ventrally; subvertical and proclined laterally; base slightly excurved. Columellar margin very narrowly tapered and curled upon itself at the base. Umbilicus closed.

Shell Variation/Remarks:

Shell shape is also ovate-pyramidal, ovate-conic or ovate-elongate with an obsoletely subangular to well-rounded periphery. Some shells have a

Figure 3. Live *A.* (*S.*) *stevenliei* n. sp. (Photo by Steven Lie)

tapered spire with slightly convex upper whorls grading to rather convex on the last, which is a little inflated to ventricose with a rounded base. Aperture shape may also be subauriform or semiovate. The palatal callus may whiten with age or after death. The parietal callus erodes and/or whitens after death. The circumumbilical band may also be dark magenta, purplish magenta or blackened, rarely diffuse on the paries and distinct outside, and sometimes very narrow. The columella is occasionally vertical or abaperturally angled only on the lower half, and sometimes darker than the lip. Apical whorls may have a wider pink band (apicosuperior fillet) below the infrasutural fillet that forms an evanescent apical swirl as seen in apical view, sometimes joined to a same-coloured apex.

There are two colour forms, 'yellow' (pale lemon) and 'pinkish brown' (pale to dark, flesh to cacao brown) (fig. 4A). The periostracum is generally colourless below the suture and

sometimes above the circumumbilical band, showing the shell colour below, and commonly has darker collabral lines. The periostracum of yellow shells is rarely plain, pale straw yellow (Figure 4B), and when of a dull green-yellow hue it gives a greenish tint to the palatum. Pinkish-brown shells have a pinkish-cinnamon or olive-tinted periostracum. The streaks of the comet-like blotches are whitish below the periostracum and appear "less distinct" on yellow shells than on pinkish-brown shells, due to the lower contrast with the pale lemon ground. The holotype represents the average conchological and periostracal features of the more common yellow shells.

The protoconch of yellow shells is sometimes subopaque and yellowish grey, cream, whitish or grey with a greyish or cream apex, rarely flesh tinted. The preapertural band may be brownish cream outside and white inside, or absent. Early teleoconch whorls are also buff, pale cream or grey tinted, and may have an obsolescent, grey supraperipheral band and/or pinkish streaks. Lower whorls may have a few scattered darker lemon streaks. The last whorl occasionally has obsolescent dark coloured basal bands (Figure 4C) or ghostly, greyish markings: spiral lines or bands above the periphery and/or a wide and submedial band with slightly darker borders (Figure 4D). These 'ghostly markings' are best viewed using transmitted light, *i.e.* by holding a shell over a lamp. Very rarely a yellow shell may appear to lack the comet-like blotches (JP), with the markings reduced to subopaque, lemon dots that are imperceptible without magnification.

Figure 4. Shell colour, periostracum and pattern variation of *A.* (*S.*) *stevenliei* n. sp.: **A** pinkish-brown shell (paratype 11, JP); **B** yellow periostracum (paratype 9, JP); **C** dark obsolescent basal bands (paratype 10, JP); and **D** ghostly submedial band (paratype 5, JA).

Pinkish-brown shells have a pink or grey-brown protoconch. The infrasutural fillet is salmon, pale flesh or creamy, and wider apically. The preapertural band is pale magenta outside and whitish inside. Early teleoconch whorls are fawn, with or without markings as per yellow shells. Brown and red-brown streaks occasionally appear on the lower whorls. Only pinkish-brown shells have a rose or magenta subsutural band below a very thin, whitish infrasutural fillet. The apex of both colour forms is the same colour as either the protoconch ground or infrasutural fillet, or different to both as in the holotype.

A. (*S.*) *stevenliei* n. sp. may have parietal tubercles, generally poorly or weakly developed when present. Shells more commonly lack both tubercles than both being present. The parieto-columellar (P-C) tubercle is generally present in combination with the parieto-labral (P-L) tubercle and is rarely alone. The P-L tubercle is never present alone and develops from a very thin and tiny, colourless smudge of callus c. 0.5 mm long adjoined to the outer lip termination (immature stage) (Figure 5A). With increased thickening it develops into a colourless tiny to small and thin to thickened, flat subtriangular lump c. 0.5-1.5 mm long (mature stage) (Figure 5B).

The P-C tubercle shows three stages of the development. It develops from a very thin, colourless smudge of callus c. 2 mm long beside the root of the columella (immature stage) (Figure 5C). A very slightly thickening from the margin inward, forms a thin lump (curved or not) c. 1-2 mm long, which is colourless, translucent whitish or magenta tinted as per columella (submature stage) (Figure 5D). Continued thickening from the base along the parietal callus margin forms a sickle-shaped (falcate) tubercle, which is wider at the base and thins toward the tip as a colourless, curved trace or line of callus (mature stage) (Figure 5E). Rarely there is a continuation of a trace thickening along the parietal margin connecting both tubercles. The circumumbilical band clearly shows through the P-C tubercle when it is immature and weakly so when submature.

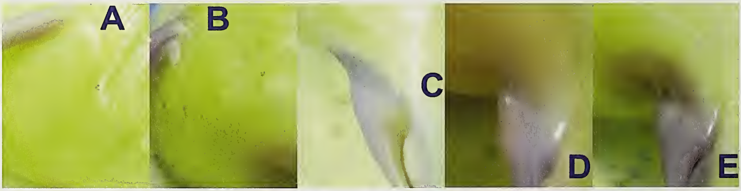


Figure 5. Parietal tubercles of *A.* (*S.*) *stevenliei* n. sp. (letters close to each one). Parieto-labral (P-L) tubercle: **A** immature (paratype 2, MNHN IM-2012-36212); **B** mature (non-type shell, JP); Parieto-columellar (P-C) tubercle: **C** immature (paratype 2, MNHN IM-2012-36212); **D** submature (paratype 11, JP) and **E** mature (non-type shell, JP).

DISCUSSION

The animal of *A.* (*S.*) *stevenliei* n. sp. (Figure 3) differs from that of *A.* (*S.*) *thalassochromus*, which is a sooty-grey body with ivory or cream granules and a darker grey or blackish dorsal stripe, plus sooty-grey tentacles with orange-brown tips (images: anonymous). Assuming I have correctly identified a live animal of *A.* (*S.*) *angulatus* (Fulton, 1896), it also has a different animal coloration: walnut brown with pale smoke-grey granules, chestnut face and a wide, vinaceous-brown dorsal stripe, plus purplish-grey ocular tentacles and brownish-orange sensory tentacles (images: anonymous). No images of live animals of *A.* (*S.*) *coeruleus* could be found for comparison, only misidentified species from southern Sarawak that have closer ties to *A.* (*S.*) *adamsii* var. C of von Martens (1867).

A. (*S.*) *quadrasi palawanensis* (Bartsch, 1928) from Brook's Point, Palawan has a chestnut animal with vinaceous-pink granules, black head, ivory foot, grey tail and black tentacles with orange-brown tips (images: anonymous). The animals of *A.* (*S.*) *pictus* (Fulton, 1896) and *A.* (*S.*) *adamsi* var. *subunicolor* (Fulton, 1896) have contrasting body-foot coloration, and both easily separated from all other species formerly mentioned (images: Liew, 2011). *A.* (*S.*) *pictus* has a blackish-purple animal with mauve granules, deep vinaceous tentacles and an ivory foot. The animal of *A.* (*S.*) *adamsi* var. *subunicolor* is quite different, having a vinaceous-fawn body with pale pinkish-buff granules, pale flesh tentacles and a purplish-grey foot.

The markings in *A.* (*S.*) *stevenliei* n. sp. are "comet-like" in the sense that the "spot/dot" is like the head of a comet, and the "streak" is the comet's tail. They are similar to what Clench and Archer (1932) described for *A.* (*S.*) *coeruleus*, which are smaller with a black dot and a small, yellowish triangular mark (Figure 6C). However, Laidlaw and Solem (1961) figured a specimen (Figure 16B, CNHM 72371 ex Laidlaw) from Baram River, not far from the type locality, and they described the markings as a small spot of intense blue at the posterior edge of an elongated yellow fleck (Figure 6D). That specimen differs from the type series in having numerous variable sized comet-like blotches like those of *A.* (*S.*) *stevenliei* n. sp., and the obsolescent or coalescent spire markings reach the last whorl.

A. (*S.*) *angulatus* has small, comet-like blotches with a blackish or dark brown dot and a short, creamy streak, more distinct on the chestnut interior (Figures 3H-I; Sutcharit *et al.*, 2015) (Figures 6A, 6B). Reduced comet-like blotches occur in *A.* (*S.*) *thalassochromus*, described by Vermueulen and Junau (2007) as a few tiny dark spots with a yellow halo scattered below the periphery, although some of these haloed dots occur above the periphery (images: anonymous). However, the holotype figure shows small comet-like blotches similar to those of *A.* (*S.*) *coeruleus* (Figure 9; Vermueulen and Junau, 2007) (Figure 6E).

Figure 6. Comet-like blotches: **A, B** *A.* (*S.*) *angulatus* (**A**, lectotype fig. 3H, and **B** paralectotype fig. 3I, Sutcharit *et al.*, 2015): **C** *A.* (*S.*) *coeruleus* (holotype, Clench & Archer, 1932); and **D** *A.* (*S.*) *thalassochromus* (holotype, Vermueulen & Junau, 2007). Degraded and reduced comet-like blotches: **E** degraded, *A.* (*S.*) *sinistralis* (lectotype fig. 14G, Sutcharit *et al.*, 2015); and **F** reduced, *A.* (*S.*) *quadrasi versicolor* (paralectotype fig. 15G; Sutcharit *et al.*, 2015).

Comet-like blotches are rarely very small and generally occur in a degraded or reduced form on shells of *A.* (*S.*) *quadrasi* and its subspecies, and species in the groups of *A.* (*S.*) *contrarius* and *A.* (*S.*) *sinistralis*. The degraded markings consist of a dot connected to a same-coloured adapertural line, and both are commonly translucent grey, but also brown or black. This line can be thin to thick and short to long, and sometimes separated from the dot by a small gap. The more common reduced markings are simple dots of the same colour (grey, brown or black), sometimes with a creamy halo.

The ghostly submedial band of *A.* (*S.*) *stevenliei* n. sp. with its slightly darker borders is a decoloured version of that seen in *A.* (*S.*) *contrarius*: narrow yellow band between or bordered by black bands. *A.* (*S.*) *quadrasi* subspecies have dark bands bordering a yellow band that is complete, obsolescent or absent, or all three bands absent. *A.* (*S.*) *coeruleus* lacks all three bands (Figures 7C, 7D). Some colour forms and subspecies of *A.* (*S.*) *adamsii* have a narrow, yellow submedial band, sometimes bordered by dark bands. *A.* (*S.*) *angulatus* has a narrow to wide, whitish or pale yellow submedial band bordered by chestnut or purple bands (Figures 7A, 7B). *A.* (*S.*) *thalassochromus* (Figure 7E) only has a thin, dark green or purplish submedial band, and sometimes has a same-coloured thin supermedial band above the periphery, which is yellow and narrow on *A.* (*S.*) *contrarius* and *A.* (*S.*) *adamsii*. This band is wider and uncoloured for *A.* (*S.*) *quadrasi* subspecies, and absent in *A.* (*S.*) *stevenliei* n. sp., *A.* (*S.*) *angulatus* and *A.* (*S.*) *coeruleus*. *A.* (*S.*) *q. everetti* also commonly has a pale lemon or creamy preapertural band that appears white inside, and absent in the other species.

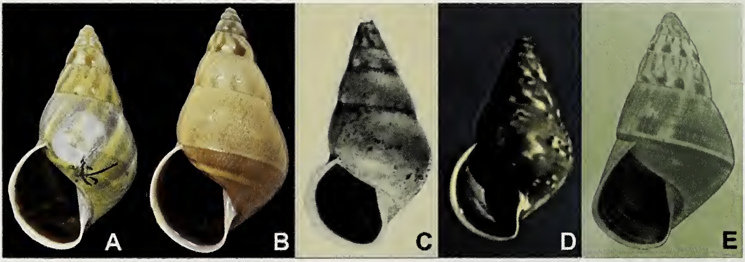


Figure 7. Nearest relatives of *A.* (*S.*) *stevenliei* n. sp.: **A**, **B** *A.* (*S.*) *angulatus* (**A** lectotype fig. 3H; H 35.1 mm and **B** paralectotype fig. 3I; Sutcharit *et al.*, 2015); **C** *A.* (*S.*) *coeruleus* (holotype, H 44.5 mm, Clench & Archer, 1932); **D** *A.* (*S.*) *coeruleus* (Laidlaw & Solem, 1961); and **E** *A.* (*S.*) *thalassochromus* (holotype, H 32 mm, Vermueulen & Junau, 2007).

Even at full maturity, the parietal tubercles of *A.* (*S.*) *stevenliei* n. sp. are less developed than mature parietal tubercles of *A.* (*S.*) *laevus janetabbasae* (Parsons, 2014). A mature P-L tubercle is flatter and lacks a gap or groove separating it from the lip like that of *A. (S.) contrarius*. A similar P-L tubercle is found in *A.* (*S.*) *laevus janetabbasae, A.* (*S.*) *maculatus* (Fulton, 1896), *A.* (*S.*) *sinistralis, A.* (*S.*) *q. quadrasi, A.* (*S.*) *q. dubius, A.* (*S.*) *q. everetti, A.* (*S.*) *q. solidus* and *A.* (*S.*) *q. versicolor*. The same type of falcate P-C tubercle formation occurs in *A.* (*S.*) *beccarii* (Tapparone-Canefri, 1883), *A.* (*S.*) *q. quadrasi, A.* (*S.*) *q. everetti* and *A.* (*S.*) *q. versicolor*. However, the falcate P-C tubercle of *A.* (*S.*) *laevus janetabbasae* has the margin thickened before the base. This also occurs in *A.* (*S.*) *beccarii, A.* (*S.*) *q. dubius, A.* (*S.*) *q. everetti, A.* (*S.*) *q. solidus* and *A.* (*S.*) *q. versicolor*. In contrast, *A.* (*S.*) *q. everetti* and *A.* (*S.*) *q. versicolor* may instead develop a curved or straightened ridge, like a flatter version of that in *A.* (*S.*) *kuehni* (von Moellendorff, 1902).

Ignoring tonal or colour variation, many species of the *A.* (*S.*) *adamsii* group display a single type of periostracal coloration. However, some species are like *A.* (*S.*) *stevenliei* n. sp. and have two types, and a few others have three or even four types. A superscript number following a species name indicates the number of periostracal types that species displays. Periostracum is plain, buff or pale tawny in *A.* (*S.*) *adamsii, A.* (*S.*) *hamatus* (Fulton, 1896), *A.* (*S.*) *angulatus*^{2}, *A.* (*S.*) *q. quadrasi*^{3}, *A.* (*S.*) *q. dubius, A.* (*S.*) *q. everetti*^{2} and *A.* (*S.*) *q. versicolor*^{4}. Viridine-yellow periostracum with lettuce-green collabral lines occurs in *A.* (*S.*) *q. quadrasi*^{3}, *A.* (*S.*) *q. solidus, A.* (*S.*) *q. versicolor*^{4} and *A.* (*S.*) *angulatus*^{2}. The periostracum of *A.* (*S.*) *q. quadrasi*^{3} may also be pale buff with darker collabral lines and that of *A.* (*S.*) *q. everetti*^{2} olive buff with deep olive collabral lines. *A.* (*S.*) *q. versicolor*^{4} may also have a primrose-yellow periostracum that has a plain, dark greenish-olive wedge behind the lip, or a viridine-yellow wedge with darker lines.

Adult shells of *A.* (*S.*) *stevenliei* n. sp. display variability in angularity or roundness of the periphery. This contrasts with its closest relatives where the periphery is: rounded for *A.* (*S.*) *coeruleus*, obsoletely subangular on *A.* (*S.*) *angulatus* and obtusely angular on *A.* (*S.*) *thalassochromus*. *A.* (*S.*) *stevenliei* n. sp. is easily separated from those three species by shell and animal coloration, although most similar in pattern to *A.* (*S.*) *coeruleus*. Those three species have a white lip and columella contrasting with vivid magenta in *A.* (*S.*) *stevenliei* n. sp., yet all four species have a similar appearance in the lip, columella, aperture shape and umbilicus.

The upper whorls of *A.* (*S.*) *stevenliei* n. sp. are quite variable in colour; commonly with an evanescent, pink apicosuperior fillet on the protoconch and grey or pinkish streaks early on the teleoconch. The apex is whitish, greyish, cream or rarely pink, but never dark coloured. Whereas, the upper whorls of *A.* (*S.*) *angulatus*, *A.* (*S.*) *coeruleus* and *A.* (*S.*) *thalassochromus* are whitish, creamy or brownish with brown stripes or flammules, which are forked above or not. These markings change colour mid-spire: bluish grey or purplish grey for *A.* (*S.*) *angulatus*, dark bluish grey for *A.* (*S.*) *coeruleus*; and yellowish green, bluish purple or brownish purple for *A.* (*S.*) *thalassochromus*. The stripes remain brown only in *A.* (*S.*) *angulatus*.

All three congeners show a change in ground colour through modification of pattern on the lower whorls. A paler suffusion appears in the interspaces of the markings, which become obsolete or coalesce on or before the last whorl. Streaks or flecks of original ground colour appear randomly on *A.* (*S.*) *coeruleus* and

sometimes form the interspaces of a supraperipheral spot-band on *A.* (*S.*) *thalassochromus*. Both of these species tend to have a paler and greyed superior zone below the suture. In *A.* (*S.*) *adamsii*, this superior zone is a paler hue, whitish or bluish grey depending on the colour form. In contrast, *A.* (*S.*) *stevenliei* n. sp. does not have the ground colour change by pattern modification, although the base is darker. The base is also darker in *A.* (*S.*) *angulatus* and in *A.* (*S.*) *thalassochromus*, and both have a narrow, yellow submedial band, which is absent in *A.* (*S.*) *stevenliei* n. sp. and *A.* (*S.*) *coeruleus*.

In summary, *A.* (*S.*) *coeruleus* has a similar primary pattern on lower whorls, but differs from *A.* (*S.*) *stevenliei* n. sp. in having a bluish-grey ground created by suffusion of stripe pigment on the spire. *A.* (*S.*) *stevenliei* n. sp. is easily separated from *A.* (*S.*) *angulatus* and *A.* (*S.*) *thalassochromus* by a different primary pattern on lower whorls of comet-like blotches on a pale lemon or pinkish-brown ground, and by differences in animal coloration. In *A.* (*S.*) *coeruleus*, *A.* (*S.*) *angulatus* and *A.* (*S.*) *thalassochromus* the lip and columella are white and the interior is dark livid purple to slate grey. For *A.* (*S.*) *stevenliei* n. sp. the lip and columella are glossy, vivid magenta and the interior is lemon yellow.

ACKNOWLEDGMENTS

I would like to thank John Abbas and Steven Lie for the supply of the types and extra material, Steven Lie for photos of the live snails and John Abbas for photos of additional specimens. I owe a debt of gratitude to the following people: Jonathan Ablett, Curator (of Non-Marine Mollusca and Cephalopoda, Division of Invertebrates, Zoology Department) (NHMUK); and Virginie Héros, Chargée de conservation collection Mollusques (MNHN) for assistance in depositing type material.

REFERENCES

Clench, W.J. and A.F. Archer. 1932. Some new land molluscs from Borneo and the Philippines, *Occasional papers of the Boston Society of Natural History* **8**: 37-42; *Amphidromus coeruleus* pp. 41 & 42, pl. 4, figs. E and F.

Fulton, H. 1896. A List of the Species of *Amphidromus*, Albers, with Critical Notes and Descriptions of some hitherto undescribed Species and Varieties, *The Annals and Magazine of Natural History*, (sixth series) **17**: 66–94, Plates V-VII.

Geddes, D. and R. Grosset. 2007. *English Dictionary and Thesaurus* with IPA, includes full colour world atlas, Geddes and Grosset, New Lanark: 1024 pp; ISBN 9781842056004.

Haniel, C.B. 1921. Variationsstudie an Timoresischen Amphidromusarten, *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, **Bd. 25** (Heft 1-2): 88 pp. (Mit 5 Tafeln, 27 Textfiguren, 5 Tabellen und einem Anhang mit den Schalenmaßen).

Laidlaw, F.F. and A. Solem. 1961. The land snail genus *Amphidromus*: A synoptic catalogue, Edited by LA Ross, *Fieldiana: Zoology* **41** (4): 503–677, 26 Text Figures.

Liew, T.S. 2011. *Bornean Terrestrial Molluscs.* Available at: http://borneanlandsnails.myspecies.info [Accessed: 18 January 2011, originally as http://borneanlandsnails.lifedesks.org]

von Martens, E. 1867. *Die Landschnecken*, Zoologischer Theil, Zweiter Band, *Die Preussische expedition nach Ost-Asien*: nach amtlichen quellen, Verlag der Königlichen Geheimen Ober-Hofbuchdruckerei, Berlin, (R. v. Decker), 447 pp. (mit XXII Illustrationen). *Bulimus adamsii* p. 336; *Bulimus adamsi* pp. 356–357; and *Bulimus adamsi* (not this species) p. 446, pl. 31, figs. 11, 12.

Petit, R.E. 2007. Lovell Augustus Reeve (1814–1865): malacological author and publisher, *Zootaxa* 1648: 1–120, ISBN 978-1-86977-172-0 (online ed.). Retrieved from http://www.vliz.be/imisdocs/publications/130389.pdf [Accessed: 9 April 2015]

Pilsbry, H.A. 1900. *Australasian Bulimulidae: Bothriembryon, Placostylus, Helicidae: Amphidromus*, Vol. XIII, *Manual of Conchology, Structural and Systematic, with Illustrations of the Species*, Second Series Pulmonata, Conchological Section, Academy of Natural Sciences of Philadelphia, Philadelphia. *Amphidromus*: pp. 127-234, pl. 46-71.

Ridgway, R. 1912. *Color standards and color nomenclature*, Ridgway, Washington DC; 44 pp and 53 coloured plates with 1150 named colours.

Severns, M. 2006. A new species and a new subspecies of *Amphidromus* from Atauro Island, East Timor (Gastropoda, Pulmonata, Camaenidae), *Basteria* **70**: 23-28.

Sutcharit, C., J. Ablett, P. Tongkerd, F. Naggs and S. Panha. 2015. Illustrated type catalogue of *Amphidromus* Albers, 1850 in the Natural History Museum, London, and descriptions of two new species, *ZooKeys* 492: 49-105, doi: 10.3897/zookeys.492.8641

University of Texas Libraries 2015, Perry-Castañeda Library Map Collection, Indonesia AMS Topographic Maps, *Bandjermasin, Borneo*, SA 50, First Edition AMS 3, East Indies 1:1,000,000, U.S. Army Map Service, 1944. Available at: http://www.lib.utexas.edu/maps/imw/txu-pclmaps-oclc-6599452-bandjermasin-sa-50.jpg [Accessed: 5 Feb 2015]

Vermueulen, J.J. and D.J. Junau. 2007. Bukit Sarang (Sarawak, Malaysia), and isolated limestone hill with an extraordinary snail fauna, *Basteria* 71 (4-6): 209-220; *Amphidromus thalassochromus* pp. 217 & 219, fig. 9.

ISSN 0738-9388

CLUB NEWS

February 20, 2016, Regular Meeting, 751 Raintree Drive, Carlsbad, CA

- Meeting called to order at 12:37 p.m.
- Pizza and soda were provided
- Speaker Sabrina Medrano, Cal Poly Pomona, gave a talk on Caliphyllidae
- Treasurer's report was given
- Editors report was given
- Shells were displayed and shells were offered for sale
- David Berschauer gave a brief talk on Busyconidae
- The door prize went to Rick Negus
- Library books discussed, list to be published online
- Announced that Paul Tuskes would be giving a talk on Florida land snails next month
- Meeting adjourned at 1:58 p.m.

March 17, 2016, Regular Meeting, Casa del Prado room 104, San Diego, CA

- Meeting called to order at 7:35 p.m.
- Excellent talk on *Liguus* land snails was given by Paul Tuskes
- Treasurer's report was given by Dave Waller
- Editor's report was given
- Library report was given by Paul Tuskes
- Paul arranged all the library books in order by geographic area
- Social Media report - 630 members on Facebook
- New committees for projects were discussed
- Club pins and mugs are available for sale now
- Honorary members discussed - Ken & Marge Lindahl were voted in as Honorary Members
- Shell Show discussed - Prototype display cases were displayed and discussed
- Paul Tuskes brought *Liguus* species to sell for the Club
- Books were made available for sale from the Club library
- Shells were displayed and offered for sale
- Announced that the annual April potluck and shell auction would take place next month
- Meeting was adjourned at 8:58 p.m.

*Liguus fasciatus castaneozonatus*Pilsbry, 1912

April 16, 2016 - Annual April Potluck and Auction

- In lieu of regular meeting. See article on p. 136

ISSN 0738-9388

Green Abalone Restoration: A Recipe for Success

Nancy Caruso, Marine Biologist
Nancy@GetInspiredInc.org

"Get Inspired" is a 501c3 nonprofit organization with a mission *to Inspire stewardship and curiosity for the natural world through the exploration of science.* We do this through our many hands on science programs for adults and children. Nancy Caruso, marine biologist and founder has been working to restore the kelp forest community of Orange County for the last 14 years. We have taught over 10,000 students to grow giant kelp, white seabass, and green abalone in their classrooms which were outplanted and monitored in the ocean by our trained team of more than 250 volunteer divers. We have successfully restored giant kelp forests in Orange County to historical densities (1913), released 300 white seabass, and completed a green abalone outplanting pilot study with much success.

Volunteers entering the water for an abalone survey.
Photo credit Nancy Caruso

Kids showing off newly collected abalone broodstock.
Photo credit Nancy Caruso

Seven abalone species once teemed the shores of California creating a multi-million dollar fishing industry employing thousands of people. The abalone was once as iconic to California cuisine as the lobster is to New England's fare. These animals were harvested for over 100 years with the commercial limit, at one time, being 120 dozen (1440 abalone) per day. It was said that the reefs looked like cobblestone streets (paved with abalone). Eventually after a century of mismanagement and the final blow of introduced disease, the fishery collapsed and we are now left with 2 endangered species, 3 species of concern, 1 species with unknown status, and 1 species that is still providing with a very limited recreational fishery in Northern California. Commercial harvesting of abalone was halted in 1997, however, since the closure; none of the species have recovered to meet the minimal population densities for successful species recovery. The status of the endangered white abalone is bleak with only 30 known individuals left on the planet.

ISSN 0738-9388

Haliotis fulgens, a.k.a. Green abalone. Photo credit Nancy Caruso

California's seven abalone species each have different ranges and habitats along our coast. Often difficult to identify, abalone species are differentiated by their shell shape, color of the tentacles, number of respiratory pores, color of the mantle, and the texture of the shell. The shell is not usually clean unlike the farm raised green abalone see in the picture above. When ordering abalone in a restaurant, ask to see the shell, a very clean shell is a good indicator that the animal was not taken illegally but instead, grown on a farm.

Black abalone are an endangered species and inhabit the intertidal to shallow subtidal areas south of San Francisco to Baja California, Mexico.

Green and Pink abalone are both found south of Point Conception to Baja California, Mexico in 5-40' of water.

Flat abalone range from British Columbia to Southern California and live at 10-70' of water.

Pinto abalone are found from San Diego to Alaska in the intertidal zone down to 70' feet.

Red abalone are found from Southern Oregon to Baja California, Mexico. In the North they are found in shallow water to 60' and in the Southern range they are often found deeper to 60'. A very limited recreational fishery still exists in Northern California counties.

ISSN 0738-9388

White abalone are endangered and range from Point conception to Baja California, Mexico, usually found in deeper waters from 60'- 100'.

Being a snail and being prized for their sweet meat, the abalone was doomed. They cannot swim away from predators (humans), their only defense is to clamp their shell down to the reef on which they live. To a non-tool using animal, that would be a perfect defense but humans use crowbars to pry the abalone from the rocks. A large red abalone can reach 10" and can feed several people. Those that are willing to brave the frigid, murky-green, northern California waters to free dive amongst the great whites along the surging coast can still enjoy a wild caught abalone meal. Others, who may not have the courage, can buy the tasty meat from abalone farms.

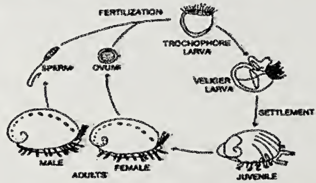
Abalone are endangered or threatened where ever they are found around the globe and efforts are underway worldwide to end the multi-million dollar underground business of poaching them. A large abalone can fetch $80 or more on the black market. It is hard to enforce the take of abalone along vast swaths of coastline, in remote locations, and at night where law enforcement patrols find it hard to reach. In California, it is said that the number of abalone taken illegally is equal to the number of abalone taken legally each year.

Abalone are residents of the rocky kelp forests with kelp being the main component of their diet. They are not active grazers but usually opportunistic foragers. Abalone often choose homes on rocks that are swept by currents and/or surge allowing them to catch drift kelp as it floats by.

Live abalone. Photo Credit Sandy Dildine

Abalone reproduce sexually having both male and female sexes. The sexes can only be identified by visually observing their gonads which are well protected under their hard shells. Males have a creamy white colored gonad while females have a blue colored gonad. Wild spawning is not well understood in abalone but techniques have been developed to spawn the animals in captive conditions although success varies with each species

Although it is known that they do broadcast their gametes into the water column, scientists are not certain what triggers abalone to spawn in the wild. After fertilization, abalone go through three different life stages before becoming an adult. Two of these lifestages are planktonic called trocophores and veligers, at this stage they are hard to see with the naked eye.



Abalone life cycle (NOAA Fisheries - government work)

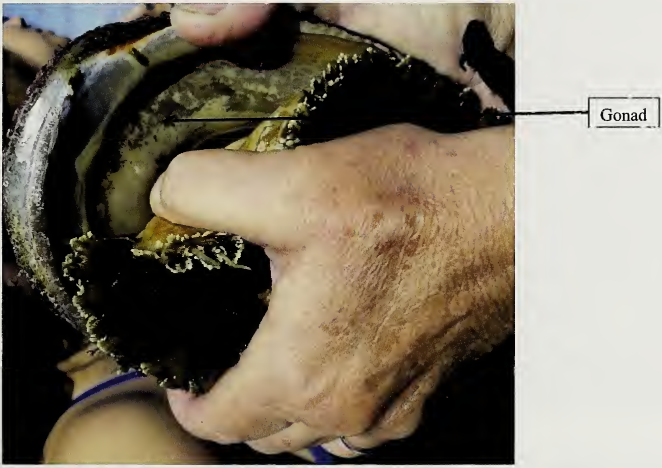
Larval and juvenile abalone live inside rock crevices and under boulders for protection from predators which include fish, lobsters, crabs, octopus, and sea stars. Just about everything in the ocean eats juvenile abalone so they stay well hidden, often only moving around at night under cover of darkness. As abalone grow larger, the predator list gets shorter and the abalone become emergent (sit on top of the reef and out in the open).

China, Japan, Australia, New Zealand, Korea, South Africa, and the United States are all trying to restore their wild abalone populations. In the US, a successful recipe for restoration has not yet been discovered. Scientists began working on species recovery in Santa Barbara in the 1970's. Believe it or not, scientists do not fully understand how to spawn all the species of abalone successfully and then there are complications with survival when planting them out on reefs. There are two different techniques used for restoration: outplanting/seeding or translocation. Translocation involves collecting wild abalone and aggregating them together to increase the chances of a successful spawn (if and when it happens). The other technique involves hatchery rearing larvae, juveniles, or adults, and then releasing them in the wild. Neither of these techniques has proven effective. Almost all of the previous outplanting projects have used small (<3") animals because the time involved in growing them to a larger size usually exceeds the grant funding period.

In 2009, Get Inspired requested permission from the California Department of Fish and Wildlife to do the first abalone outplanting in California attempted since the 1990's. The permitting process took 3 years and in 2013, Get Inspired was issued the first abalone restocking permit in nearly 20 years in California. We decided to test the hypothesis that outplanting large (>14cm) adult abalone would yield higher rate of survival given their large size; the animals would have fewer predators. The test was successful and we achieved 40% survival at the end of our 15 month outplanting project. This is notable in that no study had gone as long or had such a high number of survivors. With this recipe we believe we can restore the green abalone population in Southern California with our *Green Abalone Restoration Project.* Just like all of our other restoration projects, it must involve the community in order to create lasting committed change and we plan to involve and inspire millions of people to do just that.

ISSN 0738-9388

The *Green Abalone Restoration Project* is underway! In November we located and collected 40 wild adult green abalone from an undisclosed area (with permits) and unfortunately, it looked as if the animals had literally been starving. There has not been any giant kelp (their primary food source) since 2014 on most reefs in that area. The abalone were at least 8 years old and they had no gonads! On a gonad rating scale, they were rated 0-1 out of 3. That means that they have not had enough nutrition to put energy into developing eggs and sperm. Most likely, they have not spawned for 2 years and the population just declined again! Needless to say, it was very difficult to sex the abalone so we really don't know how many of each sex was collected yet.



Checking abalone gonads. Photo credit Nancy Caruso

After each collection day, we transported the animals down to Dana Point to the Ocean Institute in Dana Point (A project Partner). They are being fed fresh kelp every day by the Ocean Institute's staff and volunteers in the hopes of getting their gonads to develop for this year's spawning. It is thought that abalone generally spawn twice during the summer months so we are hopeful that we can spawn twice this summer in June and July. In May, we will be transporting the abalone up to The Cultured Abalone, a commercial farm. We have partnered with this business to spawn and raise our baby abalone.

ISSN 0738-9388

The plan is to raise the abalone on the farm for 1 year and then transfer as many as 100,000 of them to schools, aquariums and museums that have the capacity to hold them and grow them for 4-9 more years. Starting in the 5th year, we will start outplanting the abalone. At this size they are less likely to be eaten and they will be reproductive. Successive outplantings will continue up until age 10. This will enable us to see at what year we get the best survival. It may be possible to get the same survival at 6 years old as we do at 10 years old, then we will know we don't need to hold them as long for outplanting. We are looking for the "sweet spot" in abalone age that yields the least amount of effort and the greatest success.

Since few individuals under the age of 40 even know what an abalone is, the goal is to educate and engage the public through education in the museums and aquariums and the kids will have the hands on job of raising them in their classroom. Kids will learn water chemistry, abalone biology and ecology. The kids will be creating and maintaining their own nurseries in their classrooms even making artificial seawater. We have already piloted this in 10 schools. Hundreds of adult volunteer divers will help with the outplanting and monitoring. Our goal is for millions of people to learn the story of the abalone. This story is an important one with the theme being that in the span of one human lifetime, we have nearly eaten an animal to extinction BUT we have the ability to turn it around and restore them if we all care and work together. It gives us a chance to understand what we are capable of if we choose diversity and sustainability and maybe, just maybe we can keep this from happening again.

Resources / Contact Information:

www.gofundme.com/abalone to see a promo video and contribute to the project.
www.GetInspiredinc.org to learn more about our organization
Nancy@GetInspiredInc.org or call (714) 206-5147 to contact Nancy Caruso

West Coast Shell Show - May 21st - 22nd, 2016
So, you want to participate in the West Coast Shell Show but think that you can't because you don't have a display box? The San Diego Shell Club has solved your problem. The Club has built a limited number of display boxes for use by members. The boxes are 20 inches by 20 inches (and 5.5 inches high) in their interior dimensions, with an acrylic top and a locking mechanism. These display boxes will be made available on a first come, first served basis to either rent ($5 per box for the show) or purchase ($50 per box).

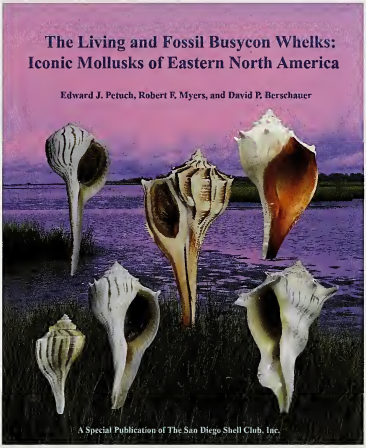
ISSN 0738-9388

The Living and Fossil Busycon Whelks: Iconic Mollusks of Eastern North America

by Edward J. Petuch, Robert F. Myers, and David P. Berschauer

Published 2015. The San Diego Shell Club, Inc. Illustrated in high color resolution photographs by Robert F. Myers. $80

Review by Tammy L. Myers
henrylimpet@cox.net



This book fully unravels the Busycon Whelks with up-to-date information and full page color plates. The color plates are exact to the species color. Easy read with evolution details, histories and map localities making it a great visual guide. Well organized and breaks down each species to genus. No flipping back and forth of pages with photo id's under pictures and each section also includes photos of variant species.

Seventeen (17) living species are discussed: *Busycon carica, eliceans, Sinistrofulgur sinstrum, laeostomum, pulleyi, perversum, Lindafulgur candelabrum, lyonsi, Busycoarctum coarctatum, Busycotypus canaliculatus, Fulguropsis spiratus, rachelcarsonae, keysensis, pyruloides, plagosus, plagosus galvestonensis, texanus.* Sixteen (16) living in the Eastern US coastal waters and one species endemic to the Yucatan Peninsula Mexico. In 1938 *Busycotypus canaliculatus* (The Channeled Whelk) was introduced by accident to the San Francisco Bay area but has been restricted to that area due to the cold waters of the Pacific. The added facts in this book gives it a no-nonsense approach and I found this book to be excellent in detail and distribution references.

Also included in this reference guide is a Living Busycon and Fossil/Paleontology information source complied in a single book which has never been achieved taking the Busycon down to their grass roots. Examples and photos of each species are provided. Great for identification and comparison for the fossil hunter and shell collector.

Habitat ecology and feeding strategies are discussed, including engulfing and "edge chipping" methods, favorite foods and principle food sources (venerid clams genus *Mercenaria*) with preferred habitat descriptions and photos of species in their natural habitat. This book is very helpful in the field.

I found this book to be an excellent reference guide with detailed descriptions and accurate color photos. Bringing together Fossil/Paleontology and the living Busycon Whelks in one source makes this book invaluable to the collector. This is a special publication of The San Diego Shell Club, Inc.

ISSN 0738-9388

The Collector's Catch-22

David Waller
505 N. Willowspring Dr., Encinitas, California 92024
dwaller@dbwipmg.com

In my last article, I discussed the information I collected on willing my shell collection to a museum or to friends and family. In this article, I relate my thoughts about donating during one's lifetime. I like to think of this type of donating as a downsizing of one's collection over a period of time as opposed to just disposing of it altogether. This method allows the collector to enjoy the pieces of his/her collection that they value most by retaining those particular specimens and divesting themselves of the remaining pieces in the collection. In my case, it has the added benefit of helping to eliminate that vision of the cracked shell coffee table my wife has promised to create when I'm gone. Even with these benefits in mind, there are problems and these problems go to the core of a Collector's existence. The first problem is convincing me that I don't need any more shells. This is no small task; a collector collects that's what we do! Not acquiring more shells means not collecting. The second problem is the thought that I can, or should, reduce the size of my collection. This is counter intuitive for a collector who usually thinks about what's missing and how he/she is going to acquire that specimen to complete their collection. Finally, the act of giving those shells to someone or some organization raises the immediate knee jerk response "Are you crazy?"

There are a few extremely generous people in the world; John Jackson was one of those special individuals who were able to transcend these problems. However, most collectors would feel that they were losing a part of themselves when giving away their shells. In Dirty Rotten Scoundrels, a movie starring Michael Cane and Steve Martin, Steve, being shown a very prestigious wine collection asks "so you drink these wines?" to which Michael Cane replies "No, they are far too expensive". Oh, so you sell them? says Steve. "Oh, no they mean too much to me" replies Michael. This is the Catch-22 that is the collector's paradigm. In reality, there comes a time in everyone's life when divesting is a better alternative than continuing to acquire. This is sometimes difficult for a collector to recognize and most would have to realize a strong incentive to make this transition.

The greatest incentive is usually money and this can be obtained either directly and indirectly. A direct method would be selling your shells outright, while an indirect method could be obtaining a tax deduction on future tax returns. Unfortunately, there are concerns about each of these approaches. Most collections have enough shells to make selling them individually a logistical nightmare. However, if you are one of those collectors that have only a few high priced specimens, then I recommend selling on Ebay. If you have not sold on Ebay before it is relatively simple. A listing requires a description and a couple photographs of the shell. After selling the shell, payment is usually received through PayPal and you must then ship the item to the purchaser. If things go well, you could quickly divest yourself of your shells and have cash in your PayPal account for other purchases. If they do not go well, then you will have to deal with returns and relisting. With all that said, it is my personal feeling that, if the shell is not being listed at a starting price of $25 or more, then it is not worth all the effort of selling it on Ebay.

ISSN 0738-9388

So what about selling your entire collection in a single transaction? Most collectors do not have the resources to purchase a collection at full retail price so you will likely be left with selling to a dealer. If you eventually decide on this, then there are some things that you need to know. Dealers are in the business of selling shells and making a profit doing so. Consequently, they cannot offer market value prices for your collection. In addition, they cannot afford to have their investment sitting in stock waiting to be sold for several years. They need this money to continue to purchase new shells. So here is the general procedure that some dealers use in evaluating your collection and making an offer. They begin by identifying the higher priced shells of the collection. Depending on the dealer they could be shells greater that $100 or greater than $500. They then evaluate the condition of each of these shells to determine its market value based on recent sales. After these values are compiled and added together most dealers will multiply this number by 0.3 some will use 0.25 and in some cases, albeit rare, 0.5. So now I'm going to try and guess your next question. Is it "So what happens with the rest of the shells, those under $100 or $500? The disappointing answer is, they become part and parcel of the offer and are not given any value. Here's the logic. These shells have a lower value because their numbers are high and they are easily acquired; most collectors have specimens of these lower value shells; they typically have a lower profit margin and they will require a significant amount of time and effort to sell. Consequently, they are considered by Dealers as having no or little value. There are some benefits to selling your collection to a Dealer. They will take the entire collection immediately and you will have cash in hand for your next venture or adventure.

The decision whether to sell or donate, comes down to which provides the best return. Selling can give you, on average, 30% of the value of the highest priced specimens in your collection. The amount that you could receive by donating and taking a tax deduction depends on your tax bracket and the actual market value of your shells, and in some instances, the actual price that you may have paid for the collection as a whole. In many cases, donating can bring a higher return. When considering the option of receiving a tax deduction for the donation of my collection I looked for information on the Internet. It is important to remember that circumstances are different for every person and if you are going to donate for a tax deduction you should check with a tax accountant to assure that you are following the IRS rules and that the donation will achieve your goals. That being said, the following guidelines were found on www.nolo.com:

1. If you want to claim a deduction for a gift worth $250 or more, get a written receipt from the charity that describes the gift. The receipt should state whether or not any goods or services were given to you in exchange for your gift; if they were, the receipt must describe them and give an estimate of their value.

2. If you make a total of more than $500 worth of noncash gifts in a calendar year, you must file a Noncash Charitable Contributions form 8283, section A, with your income tax return.

3. If you give away property worth more than $5,000, you'll probably need to get an appraisal from an IRS "qualified appraiser" (see the IRS guidelines for a qualified appraiser) and file a Noncash Charitable Contributions form 8283, section B, which must be signed by you, the appraiser and the charity. An appraisal is required whether you donate one big item or several

ISSN 0738-9388

"similar items" that have a total value of more than $5,000. For example, if you give away a hundred valuable old books, and their total value is more than $5,000, you'll need an appraisal even though you might think you're really making a lot of small gifts. The rule applies even if you give the items to different charities.

With these classifications, the IRS provides a number of donating options and for many Collectors that option will usually be the one that requires the least amount of paperwork. However, this poses problems. The primary problem being that most Collectors' decide to divest their collections much later in life, usually after retirement. Unfortunately, with retirement usually comes decreased income and less of an opportunity to receive the most benefit from a tax deduction. Another problem is that shell collections are often comprised of shells that have values close to $500, which limits the number of shells a Collector can donate in a given tax year with limited paperwork. This is a perfect reason for contacting a tax consultant to set up a plan to divest your shell collection over a period of a few to several years and optimize your tax benefit.

The incentives that can be provided by your wife and children were highlighted in my last article. Another incentive came to light when writing this article. I remember the sparkle in my son's eyes when he found his first shell on the beach. I suppose that was the same sparkle in my eye a generation earlier. The thought of being able to give that gift to someone else is a strong incentive indeed. All-in-all when considering my own mortality, I find some consolation that others who were inspired by my collecting will carry that same enthusiasm to future generations.

Taxonomic Note: Presumed hybrid *Eustrombus gigas* x *Macrostrombus costatus*.
Length 169 mm, south Andros Island, Bahamas. Coll. Virgilio Liverani. Image from recent paper.

See: Liverani, V. and U. Wieneke. 2016. Hybridization in the genus *Lobatus* (Caenogastropoda: Strombidae): a second record. Conchylia; Volume 47:1-2. (Photo published with written permission of Ulrich Wieneke and Virgilio Liverani.)

ISSN 0738-9388

April Potluck and Shell Auction
April 16, 2016

Bob Abela
4066 Brant Street, Unit 1, San Diego, California 920103
bob.abela@gmail.com

My first time with the San Diego Shell Club was at the 2012 annual shell auction and I have not missed one since. What attracts me most is the camaraderie among members and friends. Nonetheless, when faced with a table full of specimen shells up for auction, it's time to bid!

David Berschauer and Dave Waller took center stage, delighting all with a range of popular shells. There wasn't a shy mouse in the house and the bidding was jovial and spirited. During intermissions, members could peruse over tables full of $5 and $1 shells or place bids on our silent auction for books and shells. Walking away empty handed was never an option.

There was also a table with club offerings to include some recent publications, the 2016 calendar, mugs, and pins. David Berschauer also displayed one of his skillfully built display cases for members in need of one at the upcoming West Coast Shell Show.

Many thanks to all who contributed to the potluck. There were some wonderful dishes and desserts! Lastly, a special thank you to Wes Farmer for once again graciously hosting this event at his condominium's clubhouse. On behalf of the entire Club, we had a wonderful time.

ISSN 0738-9388

ISSN 0738-9388

Shell-O-Rama 2016

David P. Berschauer [1] and David Waller [2]

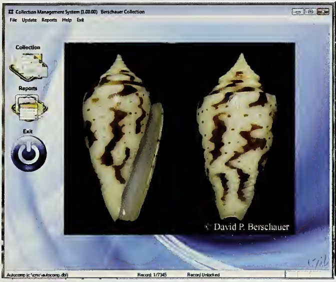
[1] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com
[2] 505 N. Willowspring Dr., Encinitas, California 92024
dwaller@dbwipmg.com

On Saturday, March 5th, 2016, Marty Beals hosted an annual gathering of friends at Tideline in Los Angeles. Approximately twenty people came from Los Angeles, Orange County, San Diego and surrounding areas with shells to show, share, and trade. David Lum from Hawaii made a short appearance, and two invited guests from South Africa won the "distant traveler" award. Our South African friends regaled us with stories and photos of marine life from their deep water technical dives in South Africa.

Shells galore covered Marty's sorting tables in the back room of Tideline, enough beautiful and rare shells to delight even the most accomplished shellers. Marty made his famous back room of specimen shells (the Abbey) available for everyone to look, or even purchase shells. We watched a fascinating presentation about diving and deep water marine life in South Africa. The photography was incredible! Marty was an excellent host as usual and served beverages and catered lunch from a local eatery. The day went by all too fast and it was time to go; until next time.

ISSN 0738-9388

ISSN 0738-9388



BACK COVER: Live *Barycypraea fultoni* (Sowerby, 1903) on reef at 85m, 90 miles south of Durban off southern KwaZulu, Natal, South Africa, April 8, 2015. Photo by Valda Fraser, published with written permission. All rights reserved. (Cover artistic credit: Rex Stilwill)

Barycypraea fultoni fultoni (Sowerby 1903)

THE Festivus

Vol. 48(3) August 2016

White *Neobernaya spadicea*

"Cambrian Explosion" of abalone

A new South African *Marginella*

A new olive from Indonesia

Cones, cones, and more cones

Quarterly Publication of the San Diego Shell Club

ISSN 0738-9388

THE FESTIVUS

A publication of the San Diego Shell Club

Volume: 48 August 2016 ISSUE 3

MEMBERSHIP AND SUBSCRIPTION

Annual dues are payable to the San Diego Shell Club Membership: Domestic/Foreign $20 (receive e-mail copy of *The Festivus*); Domestic $35 (receive *The Festivus* by mail), Foreign/outside the continental United States $55 (receive a copy of *The Festivus* by mail). Single copies of each regular issue are $10.00 plus postage.

Address all correspondence to:
The San Diego Shell Club, Inc.
P.O. Box 230988, Encinitas, CA 92023

REGULAR CLUB MEETINGS

Club meetings are held on the third Thursday or Saturday of the month, except April, September and December, at either 7:30 p.m. in Room 104, Casa del Prado, Balboa Park, San Diego, or at 12:00 noon at Holiday Inn Express, 751 Raintree Dr., Carlsbad, conference room or as noticed.

FACEBOOK

https://www.facebook.com/groups/620724271299410/

WEBSITE

http://www.sandiegoshellclub.com

Submit comments or suggestions regarding our website to our Webmaster David Waller at dwaller@dbwipmg.com.

FRONT COVER:

Live animal photo of *Festilyria africana* (Reeve, 1856), taken by Valda Fraser while scuba diving at 155 feet off Port Shepstone, Southern Kwa-Zulu-Natal Province, South Africa, on June 16, 2016; photo used with written permission, all rights reserved. (Cover artistic credit: Rex Stilwill)

MISSION STATEMENT

The San Diego Shell Club was founded in 1961 as a non-profit organization for educational and scientific purposes. More particularly to enjoy, study and promote the conservation of Mollusca and associated marine life through lectures, club meetings and field trips. Our membership is diverse and includes beginning collectors, scientists, divers, underwater photographers and dealers.

THE FESTIVUS is the official quarterly publication of the San Diego Shell Club, Inc. and is issued as part of membership dues in February, May, August and November. *The Festivus* publishes articles that are peer reviewed by our volunteer Scientific Peer Review Board, as well as articles of general interest to malacologists, conchologists, and shell collectors of every level. Members of the Peer Review Board are selected to review individual articles based upon their chosen field of expertise and preference. Available by request or on our website are:

- Guidelines for Authors
- Guidelines for the Description of New Taxa

Submit articles to Editor, David Berschauer, at shellcollection@hotmail.com

All correspondence pertaining to articles, including all submissions and artwork should be addressed to the Editorial Board.

UPCOMING CLUB EVENTS:
September Party: 9/24/16
November Auction: 11/19/16
December Party: 12/10/16

Publication date: August _1, 2016

ISSN 0738-9388

TABLE OF CONTENTS

ISSN 0738-9388

White Chestnut Cowry *Neobernaya spadicea*

Paul Tuskes
3808 Sioux Ave, San Diego, California 92117
tuskes@aol.com

ABSTRACT *Neobernaya spadicea* (Swainson, 1823) occurs from Southern California to central Baja California Sur, Mexico. Although there is no notable geographical variation in the phenotype, there are numerous color forms and unique patterns that occur throughout the population. The most unique color form is white. An examination of a limited number of white specimens determined that shell color changed after maturity; the factors that may have contributed to such a transformation are discussed.

INTRODUCTION

In this paper the unusual white form of *Neobernaya spadicea* (Swainson, 1823) is illustrated (Figure 1) and both when and how the shell might become white are discussed. In April of 2014, the author found a white *N. spadicea* at a study site on the Mission Bay Jetty, San Diego, California, and then in May 2014, the author collected a second specimen near Fish Hook on the north side of San Clemente Island. During fifty plus years of diving in Southern California these were the first the author had seen *in situ*, and it provided the opportunity to examine the nature of this unique color form.

Cypraea, and for that matter all other marine gastropods, extract calcium carbonate ($CaCO_3$) from the ocean water to build shell, a process within the scope of biomineralization. The $CaCO_3$ has a white appearance when incorporated into the shell structure. The binding material is the protein conchiolin and it is during this process that various pigments are laid down to give the shell its characteristic pattern and color (Abbott & Sandstrom, 1968). Numerous types of pigments have been identified as contributing to shell coloration and include but not limited to: carotenoids, pyrrole, indigoids, melanin, polyenes, pteridines, and porphyrins (Comfort, 1949; Comfort, 1951; Vershinin 1996; Hedegaard, *et. al.*, 2006). These materials typically have biological functions beyond pigmentation.

Figure 1. White *N. spadicea* (from the Don Pisor Collection), showing mature color and pattern under the overlaid white shell.

DISCUSSION

Neobernaya spadicea is a generalist, feeding on sessile marine invertebrates (MacGinitie & MacGinite, 1968; Tuskes, 2013). The diet of

mollusks is the source of pigments that color the shell. One common suggestion is that the white color form specimens of *N. spadicea* have a diet that lacks the necessary pigments. However, even if one organism in the diet did not have the correct assortment of pigments, or their precursors, these may be available from other organisms in their diet. This species of *Cypraea* is often found in clusters, and if diet was the cause, one might expect others feeding in the same area to also produce non-pigmented shells, however that is not the case. Although this article refers to the shell of the white color form of *N. spadicea* as non-pigmented, there is no proof that it is truly not pigmented, as white pigments could be involved.

When in development did these specimens become white? In *Cypraea* the dark browns, brown, orange, and red are thought to be derived from porphyrin groups (Comfort, 1951). Three hypotheses for when *N. spadicea* becomes white came to mind and all center on a block in the pathway that incorporates pigment (especially porphyrins) into the shell: (1) The shells may have been white since their earliest development, an albino; (2) they may have become white as the snail matured and changed from the juvenile to the adult when shape, color, and pattern change; or, (3) it may have become white after maturity. It seemed most likely that a break-down in the metabolic pathway during the change from juvenile to adult was probable. For more information on the transition of *N. spadicea* from the juvenile to the adult stage *see* Ingram, 1938.

Having two white specimens, the author masked half of the shell and removed the upper most layer of shell from the other half to determine what lay beneath. In both instances the pattern and color under the white *N. spadicea* was that of the typical mature adult specimen (see Figures 2 and 3). Placing a high intensity light on two other white specimens of *N. spadicea* (in the collection of Don Pisor) revealed that both specimens had a faint outline of the typical mature color pattern beneath the white overlay. (Figure 1) White *N. spadicea* are rarely seen, and based on these four specimens the author could not conclude that all *N. spadicea* that become white achieve this rare color form by only one path. In this instance, all four individuals had successfully incorporated pigments in the recent past and had the typical adult color and pattern prior to becoming white.

Figure 2. White *N. spadicea* from Mission Bay Jetty.

Figure 3. White *N. spadicea* from San Clemente Island.

How might these specimens become white? Rather than pigments missing from the diet of the snail, the author suspects that a failure in the metabolic pathway that: (1) prevents the pigments from passing through the gut membrane; (2) pigments are not transported to the glands that secrete them in the mantle; (3) the glands in the mantle become defective (4) a defect in the synthesis results only in the production of white pigments. or, (5) the pigments are metabolically modified in the gut or snail tissue such that they lose their activity. In other organisms the author has researched (including arthropods), pigments such as pteridines are modified to form a family of pigments such as sepiapterin (browns),

ISSN 0738-9388

xanthopterin (yellow), erythopterin (red) and leucopterin (white), with multiple pigment pathways having different end points such that various pigments may be supplied from an initial precursor. If the end point of the pathway is leucopteirn only white pigments are observed.

The author was not able to locate literature describing metabolic manipulation of porphyrins or pteridines in gastropods, only their presences in the shells of mollusks. As *N. spadicea* is a generalist feeder, the author doubts that diet alone is the cause of white *N. spadicea*, but rather that any number of metabolic processes may fail, preventing normal pigmentation in this species.

ACKNOWLEDGMENTS

The author thanks Don Pisor for allowing the examination and illustration of a specimen from his collection, and thanks Ann Tuskes for reviewing and commenting on the draft manuscript, and for recommendations from the editors.

REFERENCES

Abbott, R.T., and G.F. Sandstrom, 1968. Seashells of North America. Golden Press, NY. H. Zim, Editor.

Comfort, A., 1949. Acid-soluble pigments of shells. Biochemical Journal, 44:111-117.

Comfort, A., 1951. The Pigmentation of Molluscan Shells. Biological Reviews, 26:285-301.

Hedegarrd, C., J.-F. Bardeau and D. Chateigner. 2006. Molluscan shell Pigments: an *in situ* resonance raman study. J. Molluscan Studies 72(2):157-162.

Ingram, W.M., 1938. Notes on the Cowry, Cypraea spadicea Swainson. The Nautilus 52(1):1-4.

MacGinite, G.E. & N. MacGinite, 1968. Natural History of Marine Animals. 2nd ed. McGraw-Hill, New York, 1968. 523 pp.

Tuskes, P., 2013. Observations on the Chestnut cowry *Neobernaya spadicea* in Mission Bay. The Festivus XLV(9):77-80.

Vershinin, A., 1996. Carotenoides in Mollusca: Approaching the functions. Comparative Biochemistry and Physiology 113:63-71.

EDITORS' NOTE

Errata:

Berschauer, D.P. & E.J. Petuch. 2016. A New Species of Harpa (Gastropoda: Harpidae) from the Coral Sea Archipelago of Queensland, Australia. The Festivus 48(2):102-108.

- Type Locality: change to "dredged at 10 m depth in coral sand off East Diamond Islet, Queensland, Australia."
- Etymology: change to "species" not subspecies.
- Figure 2: Holotype shown as image "C" is 34.5 mm.

Updates:

Clark, R.N. 2016. Notes on Some Little Known Arctic Alaskan Mollusks. The Festivus 48(2):73-83.
In this paper the author introduces a new combination for the forgotten buccinid, *Buccinum rodgersi* Gould, 1860, *Anomalosipho rodgersi.* Dr. Yuri Kantor, Severtzov Institute of Ecology and Evolution, Russian Ac. Sci. Moscow, Russia. recently brought to the author's attention a very recent paper by A. V. Merkuljev, "Forgotten species from the Bering Strait – Buccinum rodgersi Gould, 1860 (Neogastropoda: Buccinidae)" Ruthenica 25 (3): 89-92. In this paper (in Russian) that author reports on the forgotten species, assigning it to the genus *Plicifusus* Dall, 1902, and includes a synonym, *Plicifusus mcleani* Sirenko, 2009. However the author believes that this species should be retained in the genus *Anomalosipho* Dautzenberg & H. Fischer, 1812, due to its lack of axial sculpture and because members of the genus *Plicifusus* have well developed axial ribs.

Clark, R.N. 2016. *Pteropurpura festiva* in Monterey Bay. Festivus 48 (1): 32.
The author reported on the finding of two specimens of *Pteropurpura festiva* in Monterey Bay, on May 7, 2011, at 12 m, and again on April 8, 2015 at 8 m. On April 4, 2016 another dive was made at the site, and several specimens *P. festiva,* up to 4 cm in length were observed and photographed.

ISSN 0738-9388

Haliotis arabiensis Owen *et al.*, 2016 specimens from Oman in the Naturalis Museum, Leiden, The Netherlands, Incorrectly Identified as *H. varia* Linnaeus, 1758, and *H. pustulata* Reeve, 1846

Buzz Owen[1] and Wilco Regter[2]
[1] P.O. Box 601, Gualala, California 95445
buzabman@mcn.org
[2] 1 Cleadon Gardens, Gateshead, NE9 7BA, United Kingdom
wilco-regter@hotmail.com

INTRODUCTION

This brief paper closely follows the publication of a *Haliotis* species new to science (*H. arabiensis* Owen, Regter, and Van Laethem, 2016), and presents the results of an examination of Omani *Haliotis* deposited in the Naturalis Museum of Leiden, Netherlands (NCB). Of the 35 total lots in this collection, 18 are catalogued as either *H. pustulata* Reeve, 1846 (now *H. rugosa pustulata*) or *H. varia* Linnaeus, 1758. The remaining 17 lots can clearly be attributed to *H. mariae* W. Wood, 1828, the common commercially taken *Haliotis* of Oman.

Regter visited the Museum in April, 2016, and photographed all specimens identified as *H. pustulata* or *H. varia*. Examination of this material clearly revealed the entire group of 27 shells were the newly described species (with the exception of one specimen of typical Philippine *H. varia* labeled as being from "Kuwait" – an obvious error).

Twenty five of the 27 specimens are illustrated on Figures 1 and 2, while Figure 3 (Tables 1 and 2) provides a key to the data for each lot when compared to the number accompanying each of the 25 specimens.

Remarks: The following background information provides details on how these specimens arrived into the Naturalis Museum collection: Robert G. Molenbeek and several other malacologists were involved with the publication of the book "Seashells of Eastern Arabia" (Bosch *et al.*, 1995) and shells collected in Oman by him and other malacologists were added to Zoological Museum Amsterdam (ZMA), Netherlands. A few years ago this ZMA collection was consolidated into the Dutch National Biodiversity Collection (NBC) in Leiden. Information on the shell data tags in the NCB collection seems to indicate that the species can also be found intertidally. Perhaps due to increased collection pressures locally, or an increased human population, this might now be more difficult. Currently, it is against the law to collect any mollusks in Oman.

The type and two paratype specimens of *H. arabiensis* are illustrated on Figure 2, images 13-15, and three specimens from United Arab Emirates are on Figure 3, images 1-4. Figure 3 also has a map of the areas where specimens have been found. (Owen *et al.*, 2016)

Abbreviations of Collections: NMNZ: National Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand; WRC: Wilco Regter Collection, United Kingdom; BOC: Buzz Owen Collection; ARC: Arjay Raffety Collection.

REFERENCES

Bosch, D. T., S.P. Dance, R.G. Molenbeek, & O. P. Graham, 1995. Seashells of Eastern Arabia, Motivate Publishing, ISBN: 1873544 64 2.

Geiger, D. L. & B. Owen. 2012. Abalone Worldwide Haliotidae. Conchbooks, Hackenheim, 361 pp., 92 pls.

Owen, B., W. Regter & K. Van Laethem, 2016. Review of the Haliotis of Yemen and Oman with Description of a New Species, *Haliotis arabiensis*, from Oman and United Arab Emirates. The Festivus 48(2):84-87, 5 figures.

ISSN 0738-9388

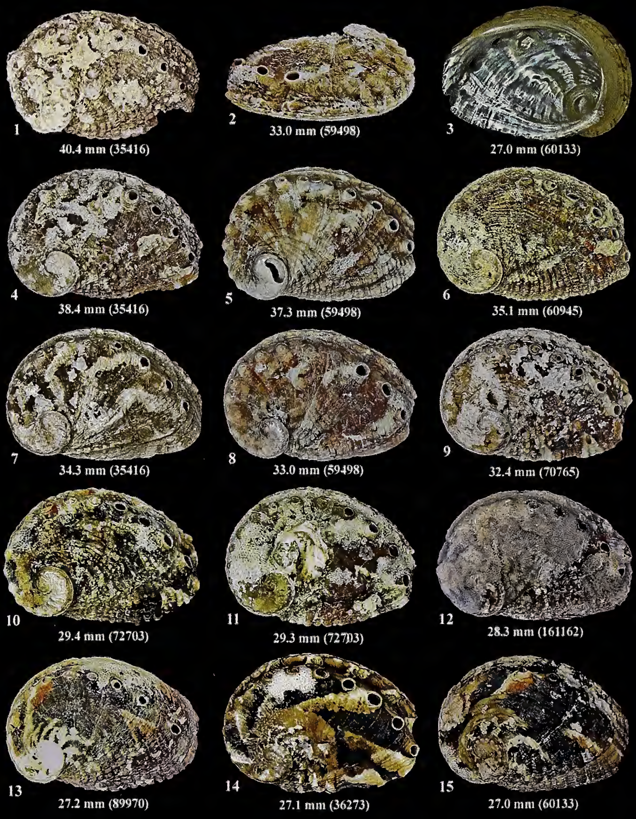


FIGURE 1. 1-15. *Haliotis arabiensis.* **Naturalis Museum collection. For details on locality data, see number in parenthesis corresponding to number on Figure 3, Tables 1 or 2.**

ISSN 0738-9388

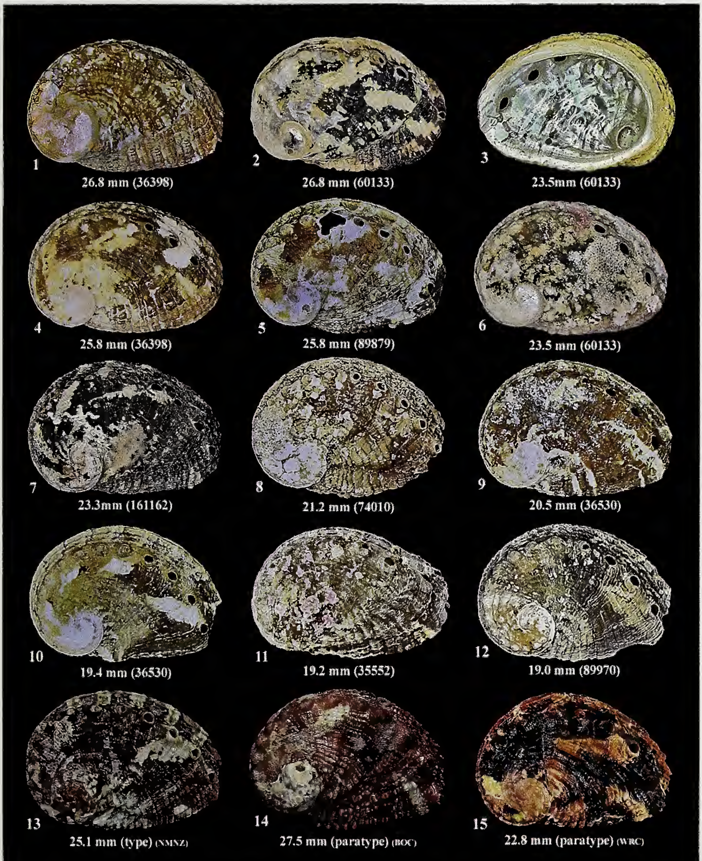


FIGURE 2. 1-12. *Haliotis arabiensis.* Naturalis Museum collection. 13-15 type and paratypes. For details on locality data, see number in parenthesis corresponding to number on Figure 3, Tables 1 or 2.

ISSN 0738-9388

Table 1 - *Haliotis arabiensis* specimens in Naturalis Museum Collection

Registration Number:	Originally Indentified As:	Locality (in Oman):	Plate & Fig. no:	Size (mm)
ZMA.MOLL.35416	*Haliotis varia*	Masirah Is., E. coast	1-1	40.4
ZMA.MOLL.59498	*Haliotis pustulata*	Masirah Is., Ras Radum, E. coast	1-2	33.0
ZMA.MOLL.60133	*Haliotis pustulata*	Muscat, 1991	1-3	27.0
ZMA.MOLL.35416	*Haliotis varia*	Masirah Is., E. coast	1-4	38.4
ZMA.MOLL.59498	*Haliotis varia*	Masirah Is., Ras Radum, E. coast	1-5	37.3
ZMA.MOLL.60945	*Haliotis varia*	Masirah Is., Ras Radum, E. coast	1-6	35.1
ZMA.MOLL.35416	*Haliotis varia*	Masirah Is., E. coast	1-7	34.3
ZMA.MOLL.59498	*Haliotis varia*	Masirah Is., Ras Radum, E. coast	1-8	33.0
ZMA.MOLL.70765	*Haliotis varia*	Masirah Is., Ras Ad Dan	1-9	32.4
ZMA.MOLL.72703	*Haliotis pustulata*	Masirah Is., Haql, beach. 1997	1-10	29.4
ZMA.MOLL.72703	*Haliotis pustulata*	Masirah Is., Haql, beach. 1997	1-11	29.3
ZMA.MOLL.161162	*Haliotis varia*	Al Bustan, Jan. 2003	1-12	28.3
ZMA.MOLL.89970	*Haliotis varia*	Oman (only data)	1-13	27.2
ZMA.MOLL.36273	*Haliotis pustulata*	Masirah Is., E. coast	1-14	27.1
ZMA.MOLL.60133	*Haliotis pustulata*	Muscat, 1991	1-15	27.0

Table 2 - *Haliotis arabiensis* specimens in Naturalis Museum Collection

Registration Number:	Originally Indentified As:	Locality (in Oman):	Plate & Fig. no:	Size (mm)
ZMA.MOLL.35416	*Haliotis pustulata*	Haramal near Muscat, 1991	2-1	26.8
ZMA.MOLL.60133	*Haliotis pustulata*	Muscat, 1991	2-2	26.8
ZMA.MOLL.60133	*Haliotis pustulata*	Muscat, 1991	2-3	23.5
ZMA.MOLL.36398	*Haliotis pustulata*	Haramal near Muscat, 1991	2-4	25.8
ZMA.MOLL.89879	*Haliotis varia*	Oman	2-5	25.8
ZMA.MOLL.60133	*Haliotis pustulata*	Muscat, 1991	2-6	23.5
ZMA.MOLL.161162	*Haliotis varia*	Al Bustan, 1/2003	2-7	23.3
ZMA.MOLL.74010	*Haliotis varia*	Dhofar Province, Hoon's Bay 11/2003	2-8	21.2
ZMA.MOLL.36530	*Haliotis pustulata*	Haramal near Muscat 11/1991	2-9	20.5
ZMA.MOLL.36530	*Haliotis pustulata*	Haramal near Muscat 11/1991	2-10	19.4
ZMA.MOLL.35552	*Haliotis varia*	Between Haramal and Al Bustan	2-11	19.2
ZMA.MOLL.89970	*Haliotis pustulata*	Oman	2-12	19.0

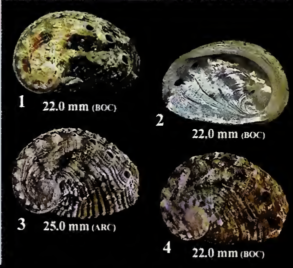


FIGURE 3 - Tables 1 & 2: *Haliotis arabiensis* specimens in Naturalis Museum with locality data corresponding to numbers appearing on Figs. 1 and 2. MAP: Red dots indicate localities specimens taken. 1-4: Specimens from Fujairah area of United Arab Emirates. 12-15 m.

ISSN 0738-9388

Description of a new species of *Marginella*: *Marginella spadix* from the East Coast Province, South Africa

Stephan G. Veldsman
Institute for Marine and Environmental Science, Pretoria, South Africa
conus@enviromarine.co.za

ABSTRACT *Marginella spadix*, a new species, is described from the East Coast Province, South Africa. The new species is compared to *Marginella minuscula* Turton, 1932, *Marginella dimidiata* Thiele, 1925 and *Marginella eucosmia* Bartsch, 1915.

KEYWORDS *Marginella, minuscula, spadix, croukampi, dimidiata, eucosmia,* East Coast Province, South Africa.

INTRODUCTION

The small *Marginella* species from the Eastern Cape - East Coast Province (Figure 1), South Africa have been discussed and researched since the early 1900's. *Marginella eucosmia* Bartsch, 1915 was first described, then *M. dimidiata* Thiele, 1925, followed by *M. minuscula* Turton, 1932. More recently, Hayes (1996) described a small white shell as *M. croukampi*. Unfortunately, the specimens he thought to be *M. minuscula,* were in fact *M. dimidiata* Thiele, 1925, and the small white shell he described was actually a specimen of *M. minuscula*. Consequently, *M. croukampi* has now become a junior synonym of *M. minuscula*. Through intensive research on the genus *Marginella* over the last 6 years by the author, it became apparent that there is another small shell in this group that has not been described, hence the description of *M. spadix*, a new species.

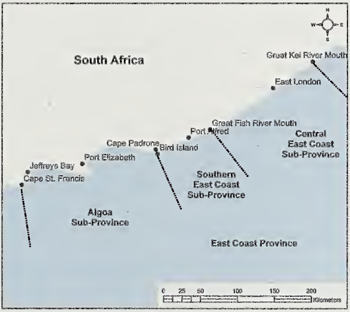


Figure 1. The East Coast Province, illustration of the Sub-Provinces and major towns where species were collected (modified after Veldsman 2014).

SYSTEMATICS

Family: **Marginellidae** Flemming, 1828
Genus: ***Marginella*** Lamarck, 1799

Marginella spadix S.G.Veldsman, new species

Description:

The shell is small in size (on average 11-14mm), fusiform-ovate in shape with a slightly rounded shoulder. Shell surface smooth, spire high, wide protoconch. No labial denticles or posterior labial notch developed. Columella, with four continuous plications, the lower (fourth) plica ending at base of shell. Callus

covering the plicae. Aperture narrow, off-white color. Thick lip, off-white color, with a few light markings on the top. Apex off-white, spire has full pattern, white, light brown and thin dark brown markings present in a block-like pattern with thin creamy spiral lines. Background color of the body whorl is off-white to light cream with a light brown block-like pattern arranged in spiral bands around the body-whorl on the first half of the shell from the shoulder, a thin off-white band around the body-whorl in the middle, followed by a dark brown block-like patterned band around the body-whorl ending at the base with a light brown to cream block-like pattern arranged in spiral bands around the body-whorl.

Type and locality:
Type locality of the Holotype of *M. spadix* new species, is East London (33°06.6'S and 27°52.5'E), Central East Coast Sub-Province, East Coast Province, South Africa; dredged 65m, on sand.

The Holotype of *M. spadix* new species is illustrated in Figure 2 (2). The type material is as follows:

Holotype:	12.07 x 7.42 mm [Figure 2 (2)]; East London (33°06.6'S & 27°52.5'E), Central East Coast Sub-Province; Dredged 65m, on sand; Coll. Natal Museum South Africa (NMSA), ID No: P0676/T4207. Donated by S.G. Veldsman.
Paratype 1:	12.71 x 7.55 mm [Figure 2 (1)]; Port Alfred, Southern East Coast Sub-Province; Scuba 20m; Veldsman Collection.
Paratype 2:	13.66 x 8.35 mm [Figure 2 (3)]; Jeffreys Bay, Algoa Sub-Province; Dredged 65-70m; Veldsman Collection.
Paratype 3:	12.06 x 7.39 mm [Figure 2 (6)]; East London, Central East Coast Sub-Province; Dredged 65m; Veldsman Collection.
Paratype 4:	13.56 x 7.76 mm [Figure 2 (5)]; East London, Central East Coast Sub-Province; Dredged 65m; Aiken Collection.
Paratype 5:	11.92 x 7.14 mm; East London, Central East Coast Sub-Province; Dredged 65m; Veldsman Collection.
Paratype 6:	11.53 x 6.81 mm [Figure 2 (4)]; Algoa Bay, Algoa Sub-Province; Scuba 13m; Coll. Natal Museum South Africa (NMSA), ID No: P0677/T4208.
Paratype 7:	13.82 x 7.69 mm; East London, Central East Coast Sub-Province; Dredged 65m; Veldsman Collection.
Paratype 8:	12.67 x 7.57 mm; East London, Central East Coast Sub-Province; Dredged 65 m; Aiken Collection.
Paratype 9:	13.45 x 7.70 mm; Jeffreys Bay, Algoa Sub-Province; Dredged 70m; Veldsman Collection.
Paratype 10:	14.01 x 7.67 mm; Algoa Bay, Algoa Sub-Province; Scuba 20-25m; Kloos Collection.
Paratype 11:	13.10 x 7.48 mm; East London, Central East Coast Sub-Province; Dredged 65m; Aiken Collection.
Paratype 12:	13.36 x 7.72 mm; Jeffreys Bay, Algoa Sub-Province; Dredged 65m; Veldsman Collection.
Paratype 13:	13.36 x 7.65 mm; East London, Central East Coast Sub-Province; Dredged 65m; Aiken Collection.
Paratype 14:	13.20 x 7.51 mm; Algoa Bay, Algoa Sub-Province; Scuba 20-25m; Kloos Collection.

Paratype 15: 13.34 x 8.04 mm; Jeffreys Bay, Algoa Sub-Province; Beach collected; Veldsman Collection.
Paratype 16: 13.88 x 7.94 mm; East London, Central East Coast Sub-Province; Dredged 65m; Aiken Collection.
Paratype 17: 13.72 x 7.82 mm; East London, Central East Coast Sub-Province; Dredged 65m; Veldsman Collection.
Paratype 18: 13.80 x 8.10 mm; East London, Central East Coast Sub-Province; Dredged 65m; Aiken Collection.
Paratype 19: 12.78 x 7.54 mm; Kwelera, Port Elizabeth, Algoa Sub-Province; Beach collected; Veldsman Collection.
Paratype 20: 12.93 x 8.10 mm; East London, Central East Coast Sub-Province; Beach collected; Aiken Collection.

Etymology:
The author believes that the term "spadix" refers to the chestnut color of the shell's pattern.

DISCUSSION

The new species, *Marginella spadix* (Figure 2) resembles *M. minuscula* (Figure 3), *M. dimidiata* (Figure 4) and *M. eucosmia* (Figure 5) in general morphology and size. Each of the three species has its own characteristic color pattern. The spire of *M. spadix* has full pattern, white, light brown and thin dark brown markings present in a block-like pattern with thin creamy spiral lines, *M. dimidiata* has full dark brown pattern, sometimes with some white markings present, whereas *M. minuscula* has an off-white and dark brown spiralling band on spire. *Marginella eucosmia* has full color pattern on the spire, with a block-like pattern consisting of red-brown blocks with white and black inserted spots.

The background color of the body whorl of *M. spadix* is off-white to light cream with a very light brown block-like pattern arranged in spiral bands around the body-whorl on the first half of the shell from the shoulder, a thin off-white band around the body-whorl in the middle, followed by a dark brown block-like patterned band around the body-whorl in the middle below the white band, and at the base a light brown to cream block-like pattern arranged in spiral bands around the body-whorl. The body-whorl of *M. minuscula* is off-white to light cream color, with no pattern, except for a thin dark brown band at the base of the shell, whereas *M. dimidiata* has brown color pattern, either in the form of spotting or blotches. *Marginella dimidiata* further has a broad dark brown band (solid to broken patterned) around the body-whorl at the lower third of the shell. *Marginella eucosmia* has an off-white background, sometimes a very faint color pattern visible over the first half of the body-whorl. The lower half of the body-whorl of *M. eucosmia* consists of a red-brown block-like pattern arranged in spiralling lines around the body-whorl, with white and black inserted spots.

ACKNOWLEDGMENTS

Special acknowledgment to the following persons: Vellies (J.H.) Veldsman for his professional input into the article, proofreading and support; Roy Aiken for supplying several Paratypes; Jacobus Kloos for supplying two Paratypes; Sulize Veldsman for careful editing of the photos; Christine Zorn from the Museum für Naturkunde Berlin (MNB), with assistance regarding the Holotype photos of *Marginella dimidiata*; Sammy de Grave from Oxford University Museum for supplying the Holotype photos of *Marginella minuscula*; Linda Davis with assistance at the Natal Museum, South Africa (NMSA) and for providing the Holotype and Paratype numbers of the new species.

REFERENCES

Bartsch, P. 1915. Report on the Turton collection of South African marine mollusks, with additional notes on other South African shells contained in the United States National Museum. Bulletin of the United States National Museum, Issued July 28, 1915.

Hayes, B. 1996. A new species of Marginella Lamarck, 1799 from the Eastern Cape, South Africa. World Shells No. 19.

Thiele, J. 1925. Deutsche Tiefsee-Expedition 1898-99 Bd. XVII Thiele, Gastropoda II. Taf. XXXIII.

Turton, W.H. 1932. The Marine Shells of Port Alfred, South Africa. Humphrey Milford, London.

Figure 2. *Marginella spadix* new species. **1.** (12.71 x 7.55 mm) – Paratype 1; Port Alfred, scuba 20m; Veldsman Collection. **2.** (12.07 x 7.42 mm) – Holotype; East London, dredged 65 m; Coll. Natal Museum South Africa (NMSA), ID No: P0676/T4207. Donated by S.G. Veldsman. **3.** (13.66 x 8.35 mm) – Paratype 2; Jeffreys Bay, dredged 65-70 m; Veldsman Collection. **4.** (11.53 x 6.81 mm) – Paratype 6; Algoa Bay, dredged 65 m; Coll. Natal Museum South Africa (NMSA), ID No: P0677/T4208. **5.** (13.56 x 7.76 mm) – Paratype 4; East London, dredged 65 m; Aiken Collection. **6.** (12.06 x 7.39 mm); East London, dredged 65 m; Veldsman Collection.

Figure 3. *Marginella minuscula* Turton, 1932. **1.** (11.02 x 6.51 mm) – Holotype; Port Alfred, beach collected; Coll. Oxford University Museum, courtesy of Sammy de Grave. **2.** (9.73 x 6.11 mm) – Paratype 1; Port Alfred, beach collected; Coll. Oxford University Museum, courtesy of Sammy de Grave. **3.** (13.56 x 7.76 mm); south of Great Kei River mouth, dredged 75 m; Veldsman Collection. **4.** (9.97 x 5.79 mm), – ex. *M. croukampi* Hayes, 1996, Paratype 1; Kenton-on-Sea (south-east of Port Alfred), scuba 18-20 m; Coll. Natal Museum South Africa (NMSA), ID No: V4255/T1448. **5.** (11.01 x 6.51 mm) – ex. *M. croukampi* Hayes, 1996, Holotype; Kenton-on-Sea (south-east of Port Alfred), scuba 18-20 m; Coll. Natal Museum South Africa (NMSA), ID No: V4254/T1447. **6.** (12.54 x 7.39 mm); East London, beach collected; Veldsman Collection. **7.** (13.22 x 8.02 mm); East London, beach collected; Veldsman Collection.

ISSN 0738-9388

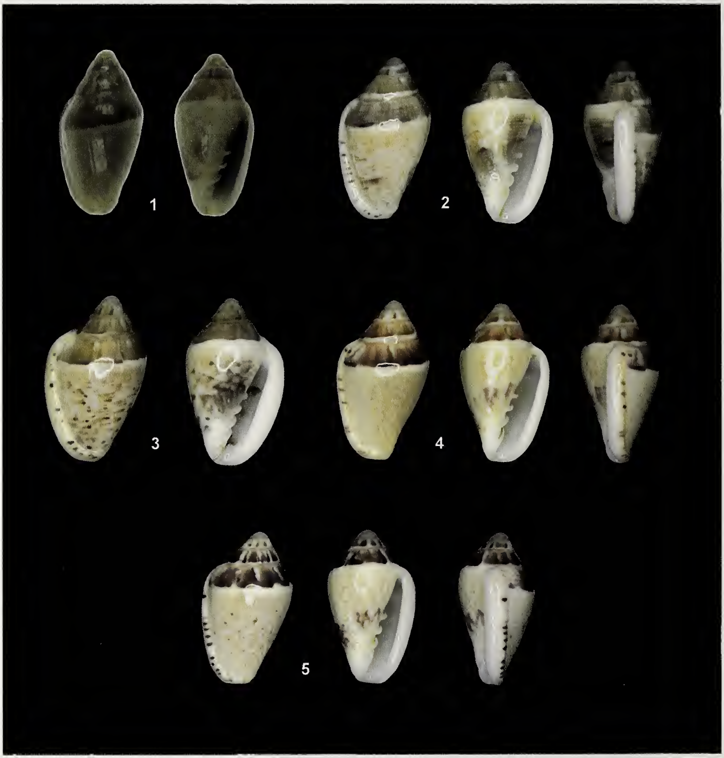


Figure 4. *Marginella dimidiata* Thiele, 1925. **1.** (11.53 x 5.93 mm) – Holotype; Cape St. Francis, dredged; Coll. Museum für Naturkunde Berlin, courtesy of Christine Zorn. **2.** (11.52 x 6.36 mm); Port Elizabeth, scuba 25 m; Veldsman Collection. **3.** (12.46 x 7.35 mm); Jeffreys Bay, dredged 75 m; Veldsman Collection. **4.** (11.16 x 6.34 mm); Port Elizabeth, scuba 25 m; Veldsman Collection. **5.** (10.78 x 6.22 mm); Port Elizabeth, scuba 25 m; Veldsman Collection.

ISSN 0738-9388

Figure 5. *Marginella eucosmia* Bartsch, 1915. **1.** (12.50 x 6.00 mm) – Illustration of Holotype (Bartsch 1915); Port Alfred, beach collected. **2.** (10.83 x 6.44 mm); Port Elizabeth, beach collected; Veldsman Collection. **3.** (10.70 x 6.14 mm); Xora River mouth, beach collected; Veldsman Collection. **4.** (11.01 x 6.34 mm); Xora River mouth, beach collected; Veldsman Collection. **5.** (10.19 x 6.21 mm); Jeffreys Bay, beach collected; Veldsman Collection. **6.** (10.24 x 5.96 mm); East London, beach collected; Veldsman Collection. **7.** (11.10 x 6.21 mm); Jeffreys Bay, beach collected; Veldsman Collection. **8.** (11.38 x 6.42 mm); East London, beach collected; Veldsman Collection.

ISSN 0738-9388

The "Cambrian Explosion" – a study of the abnormally large population of *Haliotis kamtschatkana kamtschatkana / kamtschatkana assimilis* "intergrades" following species decline due to several years of unusually warm temperatures in San Luis Obispo County, California

Buzz Owen
P.O. Box 601, Gualala California 95445
buzabman@mcn.org

INTRODUCTION

This article describes an intriguing event that took place in the Morro Bay area of Central California from the late 1950's to about 1968. It began with a serious ecological change which caused an apparent disruption of the usual ocean currents and temperature which lasted approximately two years: 1957 and 1958 (Cox, 1962). During this period, the sea temperature was unusually warm, and the usual heavy growth of brown algae (kelp) that generally grows abundantly in the cold (10-12 degrees Celcius) spring and summer seas, didn't appear. The local *Haliotis rufescens* Swainson, 1822, populations became severely food depleted and ceased growing normally. Thus, commercial abalone divers were unable to harvest sufficient numbers of legal-sized abalone to sustain the fishery. Many divers living in the Morro Bay area left the fishery and took up other lines of work. The abnormally warm water conditions persisted for over two years, and many adult abalone lost tissue size dramatically, stopped producing gonadal tissue (gametogenesis), and didn't spawn. The usual abundance of red and brown algal *Haliotis* food species ceased to exist, and the underwater Morro Bay area assumed the appearance of a barren wasteland (D. Gallagher, S. Pearce, G. Bickford, K.W. Cox, personal communication).

This article also confirms a suspicion long held by a number of specialists in West Coast *Haliotis* taxonomy: that the populations of abalone which have been called *H. kamtschatkana kamtschatkana* and *H. kamtschatana assimilis* which range from throughout California and into Mexico actually represent a single species, and not a pair of subspecies. A more thorough and detailed study supporting this conclusion is in progress.

OBSERVATIONS AND DISCUSSION

In 1959, the cold-water temperatures abruptly returned, and extremely rapid growth of large, brown algal forms resumed, especially *Nereocystis leutkeana*, the large "Bull" kelp which is the primary food for the *Haliotis* species of this area (with the possible exception of *H. cracherodii cracherodii* Leach, 1814). The animals which survived the two-year warm water period, began growing rapidly – both shell and animal - developing gonadal tissue and spawning profusely within a few months (in late 1959, and again in mid 1960). Many of the divers who had left the fishery, returned in 1961 to discover that very large numbers of sub-legal-sized animals had rapidly grown and become legal size. Huge landings of red abalones were suddenly common-place in the Morro Bay fishery. At depths greater than 15 m (50 feet), occasional specimens of *H. kamtschatkana* ssp. could be observed by divers who were harvesting the much larger red abalone (*H. rufescens*). They were of little or no interest to the great majority of commercial *Haliotis* divers, as they were too small (usually <125 mm), not very common, and no fishery

existed for the species. However, not being regulated by a size limit in the early 1960's, specimens of *H. kamtschatkana* ssp. could be taken legally.

It was about this time (1960-1961) that I first started diving the Morro Bay area commercially, and I almost immediately noticed these small *Haliotis* and started paying close attention to them, as they were considered an uncommon species to shell collectors. At that time, most I observed were "older" specimens, and it was unusual to find shells that weren't damaged by erosion and/or boring or encrusting organisms on their exterior surfaces. Young fast-growing specimens appeared nonexistent. What I hadn't realized at the time was that the warm water temperature and lack of algal food species that had existed in the late 1950's, had affected more than just the large red abalone - additionally it had had a profound effect on this species (and very probably other algae grazing mollusks) as well. Thus it was in about the fall of 1962 when I first started noticing the incredible phenomenon that was beginning to occur throughout many areas outside of approximately 15 m depth: small sub-adult (50-75 mm) *H. kamtschatkana* ssp. were starting to move out of the protection of crevices, where they were too small and hidden to be noticed previously. Careful examination of these animals, reinforced with knowledge gained a few years later in a commercial *Haliotis* hatchery, clearly indicated they were two to three years old (50-75 mm). Closer to shore, in shallower water (approximately 8-12 m), many juvenile specimens of *H. rufescens* became apparent, protected in crevices, with occasional 75 to 80 mm specimens starting to move out onto more exposed surfaces as well. This was happening in areas where virtually all older legal sized animals had been previously harvested. It was becoming very apparent that both species of *Haliotis* were undergoing "population explosions" as juveniles and sub-adults of both species (approximately 2-3 years of age) were abundant. Further, it was clear that these small animals were the result of spawnings that had occurred and coincided with the radical transformation that had taken place with the return of cold water and copious algal growth in 1959. From 1962 to 1965, the numbers of these fast-growing, small, adult *H. kamtschatkana* ssp. increased, and by 1964-1965, many were measuring 100 to 125+ mm. All were clearly the fast-growing, thin-shelled "new growth" animals from the extraordinarily successful recruitment events that had resulted from the spawnings of 1959 and 1960. The few older animals that were mixed in with this population were very obvious, being thick-shelled, mature, badly eroded and/or encrusted, and often almost senile. It was evident from the extremely bright and varied coloration of the thin and fast-growing shells of this population, that their diet was rich in species of red algae, in addition to the brown alga *Nereocystis leutkeana*, as the "genetic" chevron-like color patterns were heavily blended with intense shades of red. This contrasts with the dull pale blue-green colors which are so often observed in specimens from Southern California and Baja California, Mexico – the result of a diet of almost entirely brown algae.

Remarks: At the time of this writing (June, 2016), a similar situation is occurring on the coast of California that may be a parallel to the disastrous environmental conditions of 1957-1958. For the past year, a warm water mass of unknown origin has existed off the coast that has prevented the normal regrowth of the large brown algal species that sustain the *Haliotis* species, sea urchins, and other herbivorous mollusks. As a result, starvation on a mass scale is happening with the *Haliotis* animals ceasing to add new shell increment, visibly losing weight and weakening where many

cannot maintain attachment to the bottom substrate and are torn loose during large winter swells. Cursory diving these areas reveals that all algae food species are gone and that the abalone are in a tissue wasting state. Additionally, a massive increase of biomass of the purple sea urchin, *Strongylocentrotus purpuratus* has coincided with this warm water increase and large areas have become completely denuded of what sparse algae remains due to this sea urchin's aggressive feeding. How long these warm water conditions will remain is unknown. A second warming trend has additionally been induced by a large "El Niño" event which is occurring simultaneously and may exacerbate this warm water problem. How long these El Niño conditions will remain in effect is also currently unknown.

CONCLUSIONS

Plates 1 through 3 illustrate examples of these brightly colored *H. kamtschatkana* ssp. specimens from the "Cambrian Explosion" – so named as the small town of Cambria, near the Hearst Castle at San Simeon, is near the center of the area where this brief and extreme population explosion was observed. During the years 1963-1965, literally thousands of *H. kamtschatkana* ssp. could be observed during 4-5 hours of diving commercially for the larger red abalone. Unfortunately, in 1968, the Sea Otter, *Enhydra lutris*, encroached into this area of the California coastline, and decimated both the red abalone fishery and all exposed animals (over approximately 35-40 mm) of this beautiful small abalone species. To my knowledge, extremely few *H. kamtschatkana* ssp. specimens had been taken from this area, as virtually no commercial abalone divers of that time collected these small *Haliotis*. Thus, the specimens illustrated on these plates may represent a large percentage of the "Cambrian Explosion" *H. kamtschatkana* ssp. specimens that exist in collections.

The Cambria area is located approximately in the center between the areas where what has been called the southern subspecies (*H. kamtschatkana assimilis* Dall, 1878) and northern subspecies (*H. k. kamtschatkana* Jonas, 1845) are distributed. Interestingly, the morphology of the *H. kamtschatkana* ssp. specimens collected in the Cambria area exhibit traits of both subspecies, which explains why this localized population could be described as "intermediate" between the typical northern and southern forms. These differences may be described as follows: (1) Shell proportions - Northern shells are more elongate with an elevated spire; southern specimens are more round in proportion and the spire is usually low and often depressed into shell; (2) Surface sculpture - Northern shells have a quite lumpy surface, often with strong folded ridges, and usually show little, or very weak, spiral ribbing; southern specimens often have a smooth surface usually lacking a lumpy surface, and frequently have strong spiral ribbing. (3) Groove below row of holes - Northern shells possess a strong and deep channel in the peripheral area between the holes and columella; southern shells have a much weaker and more shallow channel in this area. (4) Shell thickness - Northern shells tend to be quite thin and very light in weight; southern shells are often thicker and heavier. On Plate 1, Images 1-8 illustrate shells of a more northern morphology, whereas Images 9-16 illustrate shells of a more southern morphology. The remainder of the specimens on all three plates show a mixture of characteristics from the typical northern and southern forms and could be best be described as "intermediate" between the two extremes. Additional specimens of both subspecies in their more typical forms are illustrated on Plates 32 and 33

in *Abalone Worldwide Haliotidae* (Geiger & Owen, 2012).

There is debate whether the species *kamtschatkana* is properly parsed into two subspecies (*kamtschatkana kamtschatkana* and *kamtschatkana assimilis*), is just one single highly variable species, or should become two different species. If two subspecies or even two different species designation is indeed appropriate, there is debate on the range and characteristics of the two. Owen and Raffety plan to consider these subjects, review countless shell specimens of these enigmatic animals, and draw a conclusion of how these issues should be resolved. This will take place in a future publication, so for the time being, the current designation of subspecies is being withheld for the article at hand.

REFERENCES

Cox, K. W. 1962. California Abalones, Family Haliotidae. *California Department of Fish and Game,* Fish Bulletin 118:1-131, pls. 1-8.

Dall W. H. 1878. Description of a new species of shell from California in the collection of the National Museum. *Proceedings of the United States National Museum* 1:47- 48.

Geiger, D. L. & Owen, B. 2012. Abalone Worldwide Haliotidae. *Conchbooks*, Hackenheim, 361 pp., 92 pls.

Jonas, J. H. 1845. Neue Conchylien. *Zeitschrift für Malakozoologie* 3:168-173.

In Memoriam

Robert Kershaw of Narooma, Australia, passed away on July 1, 2016, after a battle with an aggressive form of skin cancer. He will be sorely missed by friends, family and the malacological community. Robert discovered a new subspecies of abalone on Niue Island, which was named after him by his lifelong friend Buzz Owen as *Haliotis jacnensis kershawi* Owen, 2012. A more lengthy and proper memoriam is being written by Buzz Owen and will be published in a future issue of The Festivus.

Miriam & Buzz Owen, and Robert Kershaw at Lord Howe Is.


Haliotis jacnensis kershawi Owen, 2012, 13.0 mm
Robert Kershaw Collection

ISSN 0738-9388

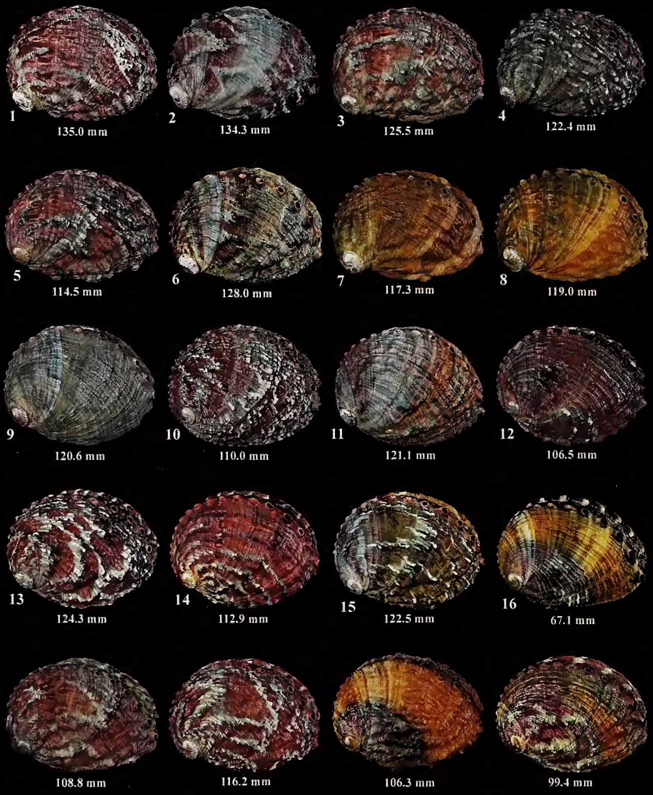


Plate 1

All Rows: *Haliotis kamtschatkana kamtschatkana/kamtschatkana assimilis*. 1-8 = more "northern" morphology. 9-16 = more "southern" morphology. Bottom row variable (more or less intermediate morphology). Cambria to Point Estero, California. 20-25 m. Live taken 1961-1963.

ISSN 0738-9388

Plate 2

All Rows: *Haliotis kamtschatkana kamtschatkana/kamtschatkana assimilis* "Intergrades". Cambria to Point Estero, California. 20-25 m. Live taken 1961-1963.

ISSN 0738-9388

Plate 3

All Rows: ***Haliotis kamtschatkana kamtschatkana/kamtschatkana/assimilis*** **"Intergrades". Cambria to Point Estero, California. 20-25 m. Live-taken 1961-1963.**

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 3

Nutricola lordi (Baird, 1863) [Bivalvia: Veneridae] depth extension recorded in Puget Sound, Washington

Angela Eagleston[1] and Paul Valentich-Scott[2]

[1] Washington State Department of Ecology, 300 Desmond Dr. SE, Lacey Washington 98503
angela.eagleston@ecy.wa.gov
[2] Santa Barbara Museum of Natural History, 2559 Puesta del Sol, Santa Barbara, California 93105,
pvscott@sbnature2.org

INTRODUCTION

Nutricola lordi (Baird, 1863) is a small, moderately common, venerid bivalve extending from the Bering Sea, Alaska, to Punta Pequeña, Baja California Sur, México (Coan & Valentich-Scott, 2012). Due to its diminutive size, the species is often overlooked as a juvenile, or misidentified. We herein extend the known depth distribution of *N. lordi* by an order of magnitude, and provide an expanded description and illustrations of the species.

Coan *et al.* (2000) and Coan & Valentich-Scott (2012) record the bathymetric distribution of *N. lordi* (Baird, 1863) to extend from the intertidal zone to 22 m. Based on records from Washington State Department of Ecology (Ecology), the depth for *N. lordi* is here extended by over 240 m (Table 1, Figure 1). The deepest depth recorded by Ecology for *N. lordi* was 268 m, collected in 1992 at Historical Station 26 (Central Basin). The earliest Ecology record in 1989 shows *N. lordi* collected at 195 m from Temporal Station 38 (Point Puily). Eagleston and Valentich-Scott examined *N. lordi* specimens from several deep water stations to confirm the old Ecology records and to validate this depth extension.

Description: Shell small (to 10 mm), trigonal, thick, moderately inflated; beaks small but prominent; subequilateral to posterior end slightly longer; dorsal margin strongly sloping down from beaks; anterior and posterior ends broadly rounded; sculpture of commarginal striae and fine ribs, stronger anteriorly; periostracum translucent, yellow-white, shiny; lunule broad, moderately shallow; escutcheon absent; pallial sinus short, broad, rounded, directed between the anterior adductor muscle scar and the cardinal teeth; three cardinal teeth in each valve; without lateral teeth. (*See* Figures 2-4)

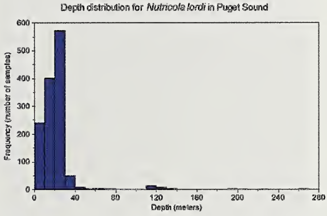


Figure 1. Depth distribution of *N. lordi* in Puget Sound, Washington.

REFERENCES

Coan, E.V., Valentich-Scott, P., and F.R. Bernard. 2000. *Bivalve seashells of western North America. Marine Bivalve Mollusks from Arctic Alaska to Baja California.* Santa Barbara Museum of Natural History Monographs Number 2. Studies in Biodiversity Number 2. Santa Barbara: Santa Barbara Museum of Natural History. 764 pp.

ISSN 0738-9388

Coan, E.V. and Valentich-Scott, P. 2012. *Bivalve seashells of tropical west America. Marine bivalve mollusks from Baja California to northern Perú.* Santa Barbara Museum of Natural History, Monographs 6. Studies in Biodiversity 4. Santa Barbara, California. 1258 pp.

Material examined					
Qty	Project	Station ID	Location	Date	Depth (m)
1	Historical	14 (Rep 2)	Hood Canal, Bangor	01 April 1989	133
1	Historical	26 (Rep 1)	Central Basin	01 April 1992	268
1	Temporal	29 (Rep 1)	Shilshole	18 April 2000	199
9	Regional	323	Coon Bay	14 June 2004	103
97	Regional	3855	Useless Bay	18 June 2014	80

Table 1. Listing of "deep-water" *N. lordi* specimens examined by the authors.

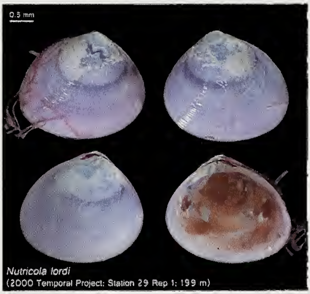


Figure 2. Typical "deep-water" (199 m) *N. lordi* from Puget Sound Washington.

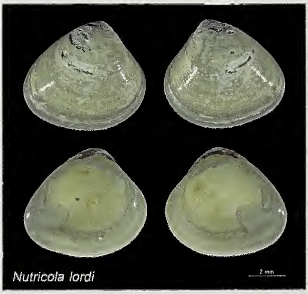


Figure 3. Interior and exterior views of *N. lordi.*

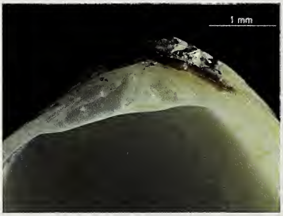


Figure 4. Interior view of hinge of right valve of *N. lordi.*

ISSN 0738-9388

Viduoliva tricolor abbasi, new subspecies (Gastropoda: Olividae) from Indonesia

Nguyen Ngoc Thach [1] and David P. Berschauer [2]

[1] Former Research Associate, Oceanographic Institute Nha Trang, Vietnam
kurodashvietnam@yahoo.com
[2] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com

ABSTRACT A new *Viduoliva* Petuch & Sargent, 1986 taxon is described from Solor Island, Indonesia and compared with *Viduoliva tricolor* (Lamarck, 1811), *Viduoliva vidua* form *cincta* (Dautzenberg, 1927), *Viduoliva reticulata* form *azona* (Dautzenberg, 1927), *Miniaceoliva irisans* (Lamarck, 1811) and *Mineaceoliva caerulea* (Röding, 1798).

KEYWORDS Gastropoda, Olivoidea, Olividae, *Viduoliva*, Solor Island, Indonesia, new subspecies.

INTRODUCTION

Viduoliva is a major genus within Olividae with many species collected in Indonesia. In the summer of 2011, two specimens of another *Viduoliva* taxa were collected. This taxon was not included in the works by Dharma (2005), Thach (2015), Springsteen & Leobrera (1986), Hinton (1972), Wilson (1994), Swennen *et al.* (2001), Zeigler (1969), Abbott & Dance (1986), Tursch & Greifeneder (2001) and Sterba (2003). In this article, it is described as new to science.

Abbreviations:
ANSP Academy of Natural Sciences Philadelphia, USA
MNHN Muséum National d'Histoire Naturelle, Paris, France
SH Shell height

SYSTEMATICS:
Class Gastropoda Cuvier, 1797
Superfamily Olivoidea Latreille, 1825
Family Olividae Latreille, 1825
Genus *Viduoliva* Petuch & Sargent, 1986
Type species: *V. vidua* (Röding, 1798)

Viduoliva tricolor abbasi Thach & Berschauer new subspecies (Figures 1-10)

Diagnosis: *Viduoliva tricolor abbasi* n. ssp. is readily recognized by its characteristic grayish blue color without orange dashes, widely-spaced axial stripes, broad or numerous spiral bands, slightly convex lateral sides and yellow plications plate with highly raised plaits at the fasciole.

Description: Shell medium-sized for the genus (39.2-44.2 mm in height) and slightly cylindrical in shape with inflated whorls. Spire low onion-shaped and ornamented by black tangential strokes with orange margins, apex highly raised. Body whorl cloak glossy with slightly convex sides, broad double spiral band and widely-spaced axial stripes, pattern-free shoulder zone very narrow. Shell width 48.4% of shell height (after measurements made on two types). Filament channel open and occupying 1.5 whorls, posterior callus slightly above level of channel. Anterior band with blackish dots, fasciole with highly raised plaits that are separated by deep grooves. Parietal wall with strong distinct and regular parietal plaits.

ISSN 0738-9388

Aperture elongate with length 88.9% of shell height, outer lip thick with numerous black dots at outer margin. Color grayish blue (without orange dashes on dorsal side) with darker spiral bands and axial stripes, yellow plications plate, bluish white aperture and white apex.

Type material: Holotype 39.2 mm SH in ANSP (Figures 1-5 & 10b). Paratype 44.2 mm SH in MNHN (Figures 6-10a); Holotype and Paratype from type locality.

Type locality: Solor Island, Indonesia.

Habitat: The specimens were found at 30m from the shore in fine white sand with sea grass on sand banks off Northeastern part of Island.

Etymology: This new species is named in honor of John Abbas who discovered the type material.

DISCUSSION

• *Viduoliva tricolor abbasi* n.ssp. is closest to *Viduoliva tricolor* (Lamarck, 1811) (Figure 11) but differs by eight characters that are summarized in Table 1.

	V. tricolor abbasi n. ssp.	*V. tricolor*
Spiral bands	Broad or more numerous	Narrower or obsolete
Axial stripes	Widely-spaced	Usually obsolete
Color	Grayish blue	Three colors
Pattern	Lacking orange dashes	With numerous orange dashes
Lateral sides	Slightly convex	Nearly straight
Plications plate	Yellow with highly raised plaits	Yellowish with smooth or slightly raised plaits
Aperture	Bluish white	White
Mean adult size	Medium-sized (40-45 mm high)	Larger (50-55 mm high)

Table 1. Comparison of *Viduoliva tricolor abbasi* with *Viduoliva tricolor*

• *Viduoliva vidua* form *cincta* (Dautzenberg, 1927) (Figure 12) differs mainly from *V. tricolor abbasi* by not convex lateral sides, white (not yellow) plications plate, not grayish blue color and lacking axial stripes.

• *Viduoliva reticulata* form *azona* (Dautzenberg, 1927) (Figure 13) differs mainly from *V. tricolor abbasi* by tripartite (not bipartite) anterior band, not grayish blue color, cloak pattern reaching filament channel and lacking axial stripes.

• *Miniaceoliva irisans* (Lamarck, 1811) (Figure 14) differs mainly from *V. tricolor abbasi* by not convex lateral sides, not grayish blue color, tripartite (not bipartite) anterior band, plications plate paler in color and lacking axial stripes.

• *Miniaceoliva caerulea* (Röding, 1798) (Figure 15) differs mainly from *V. tricolor abbasi* by purple (not bluish white) aperture, not greyish blue color, high conical (not low onion-shaped) spire, ivory white (not yellow) plications plate and lacking axial stripes.

ISSN 0738-9388

ACKNOWLEDGMENTS

The authors sincerely thank Bernard Tursch and Dietmar Greifeneder for the photo of *Viduoliva tricolor*, and Philippe and Guido Poppe for the photo of *Viduoliva reticulata* form *azona*. Thanks are also due to the anonymous reviewers for valuable comments.

REFERENCES

Abbott, T. & P. Dance. 1986. Compendium of Seashells. American Malacologists Inc, Florida, USA, 411 pp.

Dharma, B. 2005. Recent & Fossil Shells of Indonesia. ConchBooks, Hackenheim, Germany, 432 pp.

Hinton, A. 1972. Shells of the New Guinea and Central Indo-Pacifc. Jacandra Press, Melbourne, Australia, 98 pp.

Sterba, G.H.W. 2003. Olividae A Collectors Guide. ConchBooks, Hackenheim, Germany, 172 pp.

Swennen, *et al.* 2001. The Molluscs of the Southern Gulf of Thailand. Biodiversity Research and Training Program. Bangkok, Thailand, 166 pp. & 44 color plates.

Springsteen, F.J. & F.M. Leobrera. 1986. Shells of the Philippines. Carfel Shell Museum, Manila, Philippines, 377 pp.

Thach, N.N. 2015. Shells of Vietnam. ConchBooks, Hackenheim, Germany, 337 pp. and 91 color plates.

Tursch, B. & D. Greifeneder. 2001. Oliva Shells. The Genus Oliva and the Species problem. L'Informatore, Piceno, Italy & Bosque BMT, Costa Rica, 569 pp.

Wilson, B. 1994. Australian Marine Shells. Vol. II. Odyssey Publishing Co., Kallaroo, Australia, 370 pp. & 53 color plates.

Zeigler, R.F. 1969. Olive Shells of the world. Rochester Polychrome Press, New York, USA, 96 pp.

ISSN 0738-9388

Figures 1-10: ***Viduoliva tricolor abbasi*** **n. ssp.** Solor Island, Indonesia, **Figures 1-5 & 10b:** Holotype (39.2 mm SH) in ANSP; **Figures 6-10a:** Paratype 1 (44.2 mm SH) in MNHN; **Figure 11:** ***Viduoliva tricolor*** (Lamarck, 1811) for comparison, photo of Tursch & Greifeneder; **Figure 12:** ***Viduoliva vidua*** form ***cincta*** (Dautzenberg, 1927), 48 mm for comparison; **Figure 13:** ***Viduoliva reticulata*** form ***azona*** (Dautzenberg 1927), 29.1 mm for comparison, photo of P. & G. Poppe; **Figure 14:** ***Miniaceoliva irisans*** (Lamarck, 1811), 53 mm for comparison; **Figure 15:** ***Miniaceoliva caerulea*** (Röding, 1798) 54.7 mm for comparison.

ISSN 0738-9388

Five New Species of *Jaspidiconus* Petuch, 2004 (Conilithidae: Conilithinae) from the Caribbean Molluscan Province

Edward J. Petuch[1], David P. Berschauer[2], and André Poremski[3]

[1] Department of Geosciences, Florida Atlantic University, Boca Raton, Florida 33431
epetuch@fau.edu
[2] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com
[3] 51 S Street NW, Washington, DC 20001
aporemski@gmail.com

ABSTRACT

Five new species of the endemic western Atlantic conilithid genus *Jaspidiconus* Petuch, 2004 are described from the Caribbean Molluscan Province: *Jaspidiconus boriqua* n. sp. (endemic to Puerto Rico), *Jaspidiconus culebranus* n. sp. (endemic to Culebra Island), *Jaspidiconus janapatriceae* n. sp. (endemic to Grand Cayman Island), *Jaspidiconus marcusi* n. sp. (endemic to Eleuthera Island, Bahamas), and *Jaspidiconus masinoi* n. sp. (endemic to the Utila Cays, Honduras). With the addition of these five new taxa, 40 *Jaspidiconus* species have now been described from the Tropical Western Atlantic Region, with at least 25 others still in need of description.

KEY WORDS

Conilithidae, *Jaspidiconus*, Tropical Western Atlantic Region, Caribbean Molluscan Province, Bahamian Subprovince, Antillean Subprovince, Nicaraguan Subprovince, *Jaspidiconus boriqua*, *Jaspidiconus culebranus*, *Jaspidiconus janapatriceae*, *Jaspidiconus marcusi*, *Jaspidiconus masinoi*, Bahamas, Puerto Rico, Honduras.

INTRODUCTION

The conilithid genus *Jaspidiconus* Petuch, 2004 is the single largest group of cone shells found in the western Atlantic, containing 35 described species and at least 25 still-undescribed species. The genus also represents the largest single species radiation found within the family Conilithidae, rivalling other large species radiations seen in its sister family Conidae (such as the *Africonus* species complex of the Cape Verde Islands (Berschauer, 2015)). This species-richness reflects the widespread biogeography of the genus, with several species complexes being restricted to the three biogeographical provinces of the Tropical Western Atlantic Region (the Carolinian, Caribbean, and Brazilian Molluscan Provinces; see Petuch and Sargent, 2011; Petuch, Myers, and Berschauer, 2015). As in many conoideans, most *Jaspidiconus* species exhibit direct development and lack a long-lived planktotrophic veliger. Because of this lack of dispersibility (vagility) and the strong propensity for genetic isolation, most of the known taxa are restricted to single islands or single archipelagos, allowing for a proliferation of endemic species (Berschauer, 2015).

Recently, three new *Jaspidiconus* species were brought to our attention by several renowned

ISSN 0738-9388

shell collectors and divers, including Dr. Felix Lorenz (a new species from Grand Cayman Island), Robert Masino (a new species from the Utila Cays, Honduras), and Marcus Coltro (a new species from Eleuthera Island, Bahamas). One of the junior authors, André Poremski, also discovered two additional new species from Puerto Rico; one from the island mainland and one from nearby Culebra Island. Altogether, five new species are described here and these attest to the amazing conoidean biodiversity of the Caribbean Molluscan Province. The new taxa include:

Jaspidiconus boriqua new species (endemic to Puerto Rico)
Jaspidiconus culebranus new species (endemic to Culebra Island)
Jaspidiconus janapatriceae new species (endemic to Grand Cayman Island)
Jaspidiconus marcusi new species (endemic to southern Eleuthera Island, Bahamas)
Jaspidiconus masinoi new species (endemic to the Utila Cays, Honduras)

The holotypes of the new species are deposited in the molluscan type collection of the Department of Malacology, Los Angeles County Museum of Natural History, Los Angeles, California, and bear LACM numbers.

SYSTEMATICS

Class Gastropoda
Subclass Sorbeoconcha
Order Prosobranchia
Infraorder Neogastropoda
Superfamily Conoidea
Family Conilithidae
Subfamily Conilithinae
Genus *Jaspidiconus* Petuch, 2004

Jaspidiconus boriqua Petuch, Berschauer, and Poremski, new species
(Figure 1A & B)

Description: Shell of average size for genus, fusiform, biconic, with distinctly rounded sides; spire high and elevated, pyramidal; shoulder sharply-angled, distinctly sloping, bordered by prominent, overhanging undulating carina; carinal undulations proportionally large, producing distinct coronations on shoulder and spire whorls; body whorl polished and shiny, sculptured with 15 deeply-incised spiral sulci, which become deeper and more closely-packed toward anterior end; areas between spiral sulci ornamented with single large, wide, raised pustulated cord; base shell color violet-purple (as in holotype), bright pink, or purplish-pink; base color overlaid with prominent large dark reddish-brown longitudinally-arranged amorphous flammules, often arranged in a zebra pattern; evenly-spaced, tiny brown dots present on raised body whorl cords; coronated shoulder and carina marked with alternating dark brown and purplish-white spots, with brown spots being present between each low knob; spire whorls pale violet, marked with very prominent, widely-spaced dark brown amorphous flammules, which often connect to brown longitudinal body whorl flammules; aperture wide and flaring, becoming wider toward anterior end, cream-white within interior; protoconch proportionally large, rounded, composed of 2 whorls; protoconch and early whorls white; periostracum smooth, pale yellow, transparent.

Type Material: Holotype: length 20.7 mm, on clean coral sand near reef, 3 m depth off Playa Boqueron, Cabo Rojo, southwestern side of Puerto Rico, Greater Antilles, Caribbean Sea (collected by André Poremski), LACM 3351. **Other Material Studied:** length 21.5 mm, same locality and depth as the holotype, in the

research collection of E.J. Petuch; length 22.0 mm, same locality and depth as the holotype, in the collection of André Poremski.

Type Locality: Off Playa Boqueron, Cabo Rojo, Puerto Rico, on clean carbonate sand in 3 m depth.

Distribution: At present, known only from the southwestern coast of Puerto Rico, in the vicinity of Cabo Rojo.

Ecology: The new species prefers clean carbonate sand substrates near coral reefs and sea grass beds in depths of 2-3 m.

Etymology: Named for the "Boriquas", the Arawak-based name to which native Puerto Ricans refer to themselves; in reference to the new species being endemic to Puerto Rico. Named as a noun in apposition.

Discussion: Of the known Caribbean Province *Jaspidiconus* species, *J. boriqua* is most similar to the southern Caribbean Sea *J. jaspideus* (Gmelin, 1791) from Trinidad and Tobago and the northern Venezuelan islands (southern Grenadian Subprovince) and the coast of Venezuela (Venezuelan Subprovince) (Petuch, 2013: 133, figure 9.4C). The new northern Caribbean (Antillean Subprovince) species differs from its southern Caribbean (Grenadian and Venezuelan Subprovinces) congener in being a smaller, more slender, and more fusiform shell with more rounded sides, and in being a less sculptured shell that lacks the prominent large bead-like pustules seen on the body whorl and spire of *J. jaspideus*. The new Puerto Rican cone is also a more colorful species, having a bright violet or pinkish-violet base color and distinctive reddish-brown longitudinal flammules.

Jaspidiconus culebranus Petuch, Berschauer, and Poremski, new species
(Figure 1C & D)

Description: Shell of average size for genus, elongately fusiform, biconic, with slightly rounded sides; shoulder sharply-angled, subcarinated; spire high and protracted, slightly stepped, pyramidal; body whorl smooth and shiny, ornamented with 12-15 evenly-spaced incised spiral sulci, which become stronger and more closely-packed toward anterior end; entire shell uniform pale cream-white or whitish-orange, becoming darker on spire whorls; aperture proportionally wide, pale yellow-cream within interior; protoconch proportionally large, rounded, composed of 2 ½ whorls, pale cream-orange in color; periostracum thin, smooth, transparent yellow.

Type Material: Holotype: length17.7 mm, in 4 m depth, within pockets of clean sand among Turtle Grass beds, near the municipal landfill on Culebra Island, off eastern Puerto Rico (collected by André Poremski), LACM 3352. **Other Material Studied:** length 16.9 mm, same locality and depth as the holotype, in the research collection of E.J. Petuch; length 16.4 mm, same locality as the holotype, in the collection of André Poremski.

Type Locality: 4 m depth, within pockets of clean sand among Turtle Grass (*Thalassia testudinum*) beds, offshore of the municipal landfill, Culebra Island, northern Caribbean Sea.

Distribution: At present, known only from Culebra Island off the eastern coast of Puerto Rico. The species is apparently endemic to Culebra.

Ecology: The new species prefers clean carbonate sand substrates, in 3-4 m depths, near Turtle Grass (*Thalassia testudinum*) beds.

Etymology: Named for the type locality, Culebra Island ("Snake Island" in Spanish).

Discussion: In size, shape, and height of the spire, the new Culebra Island endemic is most similar to *Jaspidiconus boriqua* (described in the previous section), but differs in being an uncolored, uniformly pale shell which lacks any type of color pattern or markings and in being a smoother, less-sculptured shell that lacks any raised cords, beads, and shoulder coronations. As can be seen on Figure 1A, B, C & D), the protoconch of *J. culebranus* is proportionally much larger and more bulbous than that of the closely-related *J. boriqua*. The rich pale orange-cream shell color of the new Culebra cone is distinctive and is not seen on any other known Caribbean congener.

Jaspidiconus janapatriceae Petuch, Berschauer, and Poremski, new species
(Figure 1E & F)

Description: Shell small for genus, fusiform, with only slightly rounded sides; shoulder sharply-angled, bordered by large, well-developed smooth prominent carina; spire subpyramidal, only slightly stepped; spire whorls smooth and unsculptured; body whorl smooth and shiny, with 8-10 deeply-incised spiral sulci around anterior one-half of body whorl; posterior one-half of body whorl smooth and unsculptured; entire shell uniformly pure white; aperture proportionally wide and flaring, becoming wider toward anterior end, pure white within interior; protoconch proportionally large, rounded, composed of 2 whorls, pure white in color; periostracum thin, smooth, transparent yellow.

Type Material: Holotype: length 16.0 mm, on open carbonate sand sea floor in 4 m depth, near George Town, Grand Cayman Island, Cayman Islands, western Caribbean Sea (collected by Dr. Felix Lorenz), LACM 3353. **Other Material Studied:** 2 specimens, lengths 15.5 mm and 16.2 mm, same locality and depth as the holotype, in the research collection of E.J. Petuch; 2 specimens, lengths 15.7 mm and 16.0 mm, in the collection of André Poremski; and 1 specimen, length 15.7 mm, in the collection of David P. Berschauer.

Type Locality: 4 m depth on clean carbonate sand, near George Town, Grand Cayman Island, Cayman Islands, western Caribbean Sea.

Distribution: Known only from Grand Cayman Island, Cayman Islands.

Ecology: The new species prefers clean carbonate sand and open sea floors, in depths of 2-5 m.

Etymology: Named for Jana Patricia Kratzsch of Giessen, Germany, noted underwater photographer and naturalist, and life companion of Felix Lorenz.

Discussion: *Jaspidiconus janapatriceae* stands out from all the other known Caribbean *Jaspidiconus* species by being so unusually generalized and beautifully simplistic; the shell is only pure white and lacks any coloring or color pattern and, with the exception of a few incised sulci around the anterior half of the body whorl, it is essentially smooth, lacking any raised cords, pustules, or coronations. Besides its smaller-than-average size, the main distinguishing feature of the new Caymanian cone is the well-developed shoulder carina, which is proportionally larger than other congeners and which tends to extend beyond the edge of the shoulder angle.

ISSN 0738-9388

Jaspidiconus marcusi Petuch, Berschauer, and Poremski, new species
(Figure 1G & H)

Description: Shell very small for genus, averaging only 9 mm, stocky, truncated, broad across shoulder; shoulder sharply-angled, bordered by thin sharp carina; spire proportionally low, subpyramidal, only slightly stepped; body whorl smooth and shiny, ornamented with 10-12 deeply-incised spiral sulci around anterior one-half; base shell color pale Canary yellow, overlaid with wide, evenly-spaced deep orange-yellow amorphous longitudinal flammules arranged in zebra pattern; shoulder carina white, marked with widely-spaced dark reddish-brown elongated spots; spire whorls bright yellow, marked with large, widely-spaced dark reddish-brown flammules; aperture proportionally wide, bright yellow within interior; protoconch proportionally very large, rounded, bulbous, composed of 2 whorls, bright cherry red in color; periostracum thin, smooth, transparent yellow.

Type Material: Holotype: length 9.0 mm, on open carbonate sand sea floor, 3 m depth off Tarpum Bay, Eleuthera Island, eastern Exuma Sound, Bahamas, LACM 3354 (collected by Marcus Coltro); **Other Material Studied:** length 9.0 mm, same locality and depth as holotype, in the research collection of E.J. Petuch; length 8.7 mm, same locality as the holotype, in the collection of David P. Berschauer; length 10.5 mm, same locality as the holotype, in the collection of André Poremski.

Type Locality: On carbonate sand in 3 m depth, off Tarpum Bay, Eleuthera Island, eastern Exuma Sound, Bahamas.

Distribution: Known only from the Exuma Sound area of southern Eleuthera Island, Bahamas, near Tarpum Bay.

Ecology: The new Bahamian cone prefers open sea floors in quiet, sheltered lagoons, where it lives on substrates composed of fine, clean carbonate sand and silt.

Etymology: Named for the renowned diver, shell collector, and shell dealer, Marcus Coltro, of Sao Paulo, Brazil and Miami, Florida, who discovered the new species in Tarpum Bay.

Discussion: Of the 7 known Bahamian *Jaspidiconus* species (*see* Petuch, 2013: 81-85; Petuch, Myers, and Berschauer, 2015; Berschauer, 2015), *J. marcusi* is morphologically closest only to *J. oleiniki* Petuch, 2013 from the Bimini Chain of islands along the western side of the Great Bahama Bank (*see* Petuch, 2013: 85). Both species share the same stocky, broad shell shape and the same type of subpyramidal spire, but the Biminian *J. oleiniki* differs in being a larger shell with a much more stepped spire, and in lacking the bright yellow base color of *J. marcusi*, and having, instead, a pure white shell with large pale orange-pink blotches. The Eleutheran *J. marcusi* also has a more colorful spire, marked with large reddish-brown flammules, and has small brown spots along the shoulder carina; these characters are missing on the Biminian *J. oleiniki*.

Jaspidiconus masinoi Petuch, Berschauer, and Poremski, new species
(Figure 1 I & J)

Description: Shell of average size for genus, fusiform, slightly inflated, with rounded sides; shoulder sharply-angled, bordered by low, rounded carina; spire distinctly subpyramidal, only slightly stepped; body whorl smooth and

shiny, sculptured with 12-15 incised spiral sulci, which become deeper and closer together toward anterior end; body whorl base color pink or pale lavender (as on holotype), overlaid with 12-15 rows of alternating brown and white spots and also numerous widely-spaced amorphous dark tan or brown longitudinal flammules; shoulder carina white, marked with widely-spaced small brown dots; suture of spire whorls edged with tiny, evenly-spaced brown dots; some specimens (such as the specimen in the Poremski collection) are uniformly pale pink, with only traces of longitudinal flammules and bands of dots; aperture proportionally wide and flaring, becoming wider at the anterior end, deep purplish-pink within interior; protoconch and early whorls pale orange-white; protoconch proportionally large, rounded, composed of 2 whorls; periostracum thin, smooth, transparent yellow.

Type Material: Holotype: length 12.1 mm, collected at night on fine carbonate sand near Turtle Grass beds, in 7 m depth off Sandy Cay, Utila Cays, Honduras (collected by Robert Masino), LACM 3355; **Other Material Studied:** length 13.0 mm, same locality as the holotype, in the research collection of E.J. Petuch; length 12.0 mm, same locality as the holotype, in the collection of André Poremski.

Type Locality: 5-7 m depth on fine, clean carbonate sand near Turtle Grass beds, off Sanday Cay, Utila Cays, Honduras, Western Caribbean Sea.

Distribution: Known only from the Utila Cays of the Caribbean coast of Honduras.

Ecology: The new Honduran cone prefers clean, fine carbonate sand and silt, near Turtle Grass (*Thalassia testudinum*) beds, in 5-7 m depths.

Etymology: Named for Robert Masino of Naples, Florida, renowned diver, shell collector, tour guide, and amateur naturalist, in recognition of his generous donations of rare specimens to research malacologists. These have led to many important contributions to Caribbean malacology.

Discussion: Of the Honduran *Jaspidiconus* species, *J. masinoi* is most similar to *J. roatanensis* Petuch and Sargent, 2011 from Roatan Island. Both species are of similar size and have the same type of stocky, inflated shell form with rounded sides. *Jaspidiconus masinoi*, however, is a more elongated and much more colorful shell, having a base color of bright pink or lavender, marked with rows of brown dots and large brown flammules. *Jaspidiconus roatanensis*, on the other hand, is a pure white shell with a zebra-like pattern of slender reddish-brown longitudinal flammules (*see* Petuch and Sargent, 2011; Petuch, 2013:105) and characteristically exhibits rows of small pustules on the body whorl. This pustulated ornamentation is missing on the new Utila Cays cone. The distinctive deep purple-pink color seen inside the aperture of *J. masinoi* is unique among Western Caribbean *Jaspidiconus* species, and readily separates it from similar-appearing taxa.

ACKNOWLEDGMENTS

The authors thank Robert Masino (Naples, Florida), Dr. Felix Lorenz (Giessen, Germany), and Marcus Coltro (Sao Paulo, Brazil and Miami, Florida) for their generous donations of study specimens.

ISSN 0738-9388

REFERENCES

Berschauer, D.P. 2015. A comparison of adaptive radiation in Conidae and Conilithidae (Gastropoda: Conoidea) in the Eastern and Western Atlantic, together with an iconography of the conilithid genus *Jaspidiconus*. The Festivus 47(2):99-113.

Petuch, E.J. 2013. *Biogeography and Biodiversity of Western Atlantic Mollusks*. CRC Press, London, New York, Boca Raton. 234 pp.

Petuch, E.J. and D.M. Sargent. 2011. New Species of Conidae and Conilithidae (Gastropoda) from the Tropical Americas and Philippines, with Notes on Some Poorly-Known Species. *Visaya* 3(3):37-58.

Petuch, E.J., R. Myers, and D.P. Berschauer. 2015. Additions to the Cone Shell Faunas of Australia and Aruba (Conidae, Conilithidae). The Festivus 47(3):219-228.

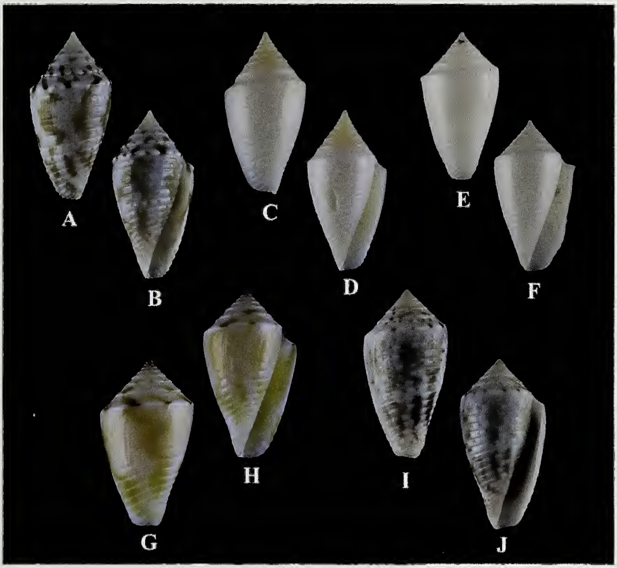


Figure 1. New Species of *Jaspidiconus* Petuch, 2004 from Puerto Rico, Culebra Island, Grand Cayman Island, Eleuthera Island, and the Until Cays. Images: A, B= *Jaspidiconus boriqua* new species. Holotype, length 20.7 mm, LACM 3351. From 3 m depth off Playa Boqueron, Cabo Rojo, Puerto Rico. **C, D=** *Jaspidiconus culebranus* new species. Holotype, length 17.7 mm, LACM 3352. From 4 m depth, off the public landfill on Culebra Island, Puerto Rico. **E, F=** *Jaspidiconus janapatriceae* new species. Holotype, length 16.0 mm, LACM 3353. From 4 m depth off George Town, Grand Cayman Island, Cayman Islands. **G, H=** *Jaspidiconus marcusi* new species. Holotype, length 9.0 mm, LACM 3354. From 3 m depth off Tarpum Bay, Eleuthera Island, Bahamas. **I, J=** *Jaspidiconus masinoi* new species. Holotype, length 12.1 mm, LACM 3355. From 7 m depth off Sandy Cay, Utila Cays, Honduras.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 3

Some spotted cone shells (subfamily Conilithinae) from the East Pacific region

John K. Tucker
Illinois Natural History Survey (Retired)
731 Cantonment, Rantoul, Illinois 61866
johntucker@gtewc.com

INTRODUCTION

Compared to the Western Atlantic cone shells, there are relatively few East Pacific cone shells. Tenorio, *et al.* (2012) identified 44 species that they placed in two families containing 21 genera. Most of the species (31 species) belong in the family Conidae. Another 13 species are members of the family Conilithidae. In contrast Kohn (2014) listed more than 50 valid species of cone shells from the Western Atlantic despite excluding species endemic to Brazil and those described after 2011. It seems likely then that there are about twice as many Western Atlantic cone shells as there are East Pacific cone shells.

Consequently the availability of a comprehensive volume on all of the East Pacific cone shell species (*i.e.*, Tenorio, *et al.*, 2012) should simplify identifications for these species. It should be noted that no new species have been described after Tenorio, *et al.* (2012) was published. Contrast that record to the near overwhelming number of new species described from the Western Atlantic, West African, and Indo-Pacific regions. Their validity is not the issue here, but their existence makes cone shells difficult to study for those that do not have access to all of the primary literature, something that most collectors do not have.

Despite the relative stability of the taxonomy of the East Pacific species, some problem areas seem to remain. A series of short articles are planned to address the most important problem areas in a simple format utilizing descriptive illustrations and figure captions rather than the full scale sort of descriptions. Such descriptions are already published along with comprehensive illustrations by Tenorio, *et al.* (2012). those interested in the East Pacific cone shells should consult that book.

This first article considers identifications for five species of spotted cone shells that belong in the Conilithidae (Figures 1 and 2, herein). The Conilithidae have radular teeth that do not have serrations or a terminating cusp (Tucker & Tenorio, 2009; Tenorio, *et al.*, 2012; Figure 3, herein). These are species that Duda & Kohn (2005) included in their small major clade based on molecular phylogenetics. The molecular based phylogenetics were actually reproduced in an independent cladistic analysis of radular and shell anatomy done by Tucker & Tenorio (2009, text-fig.13).

REFERENCES

Chaney, H. W. 1987. A comparative study of two similar Panamic cones: *Conus ximenes* and *Conus mahogani.* The Veliger 29:428-436.

Duda, T. F., Jr. & Kohn, A. J. 2005. Species-level phylogeography and evolutionary history of the hyperdiverse marine gastropod genus *Conus.* Molecular Phylogenetics and Evolution 34:257-272.

Kohn, A. J. 2014. *Conus* of the Southeastern United States and Caribbean. Princeton University Press, Princeton, New Jersey, xiii + 457 pp.

ISSN 0738-9388

Tenorio, M. J., Tucker, J. K., & Chaney, H. W. 2012. A Conchological Iconography:The Families Conilithidae and Conidae. The Cones of the Eastern Pacific. ConchBooks, Hackenheim, Germany, 112 pp.

Tucker, J. K. 1985. *Conus ximenes* J. E. Gray, 1839, *Conus mahogany* [sic] Reeve, 1843 and friends. Shells and Sea Life 17(8):201-202.

Tucker, J. K. 2007. *Conus ximenes* and C. *mahogani*: two similar but distinct species. The Cone Collector 2:5-10.

Tucker, J. K. & Tenorio, M. J. 2009. Systematic Classification of Recent and Fossil Conoidean Gastropods, with Keys to the Genera of Cone Shells. ConchBooks, Hackenheim, Germany, 296 pp.

Tucker, J. K. & Tenorio, M. J. 2013. Illustrated Catalog of the Living Cone Shells. MdM Publishing, Wellington, Florida, iv + 517 pp.

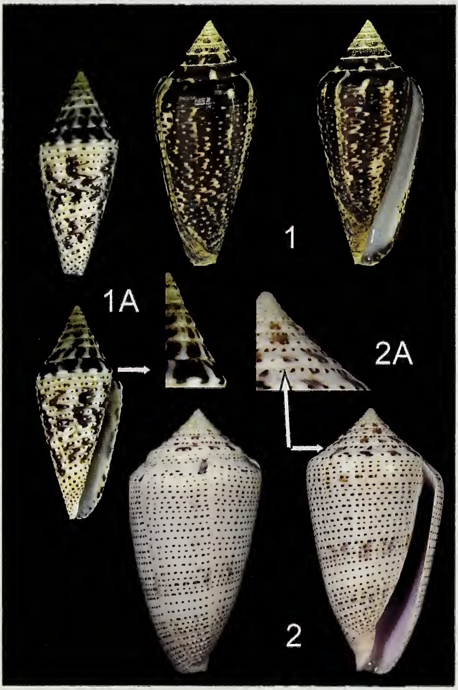


Figure 1. Two species of *Ximeniconus* from the East Pacific. Figure 1(1). Specimen of *Ximeniconus mahogani*, 34.4 mm shell length, from Venado Island, Panama, Illinois Natural History Survey (INHS) 44548. Note the absence of a row of small spots along the suture between adjacent whorls (Fig. 1(1A). Figure 1(1A). Specimen of *Ximeniconus mahogani*, 26.1 mm shell length, from Quevedo, Sinaloa, West Mexico (John K. Tucker collection (JKT) 6577) that is not so darkly colored as is the one shown in Figure 1(1). Body also has well-spaced, pustulose spiral ridges but spire is not scalariform and posterior notch is shallow confirming the identification as *X. mahogani* despite the light coloration. An enlargement of the spire is shown demonstrating the absence of a row of spots along the suture between adjacent whorls, which is present in *X. ximenes*. The spire whorls of *G. tornatus* are distinctly scalariform but like *X. mahogani* do not have that row of small spots along the suture (Fig. 3(4)). Figure 1(2). Specimen of *Ximeniconus ximenes* 52.6 mm shell length from San Felipe, Baja California, Mexico, Manuel J. Tenorio (MJT) collection. Arrow points to a row of small spots along the suture between adjacent whorls (also see enlargement in Figure 1(2A). These spots are only present in *X. ximenes* (Tucker, 1985 and 2007; Chaney, 1987). The enlargement of the anterior end of *X. ximenes* in Fig. 2(2B) shows the lack of development of an anterior notch (compare to Fig. 2(5A)).

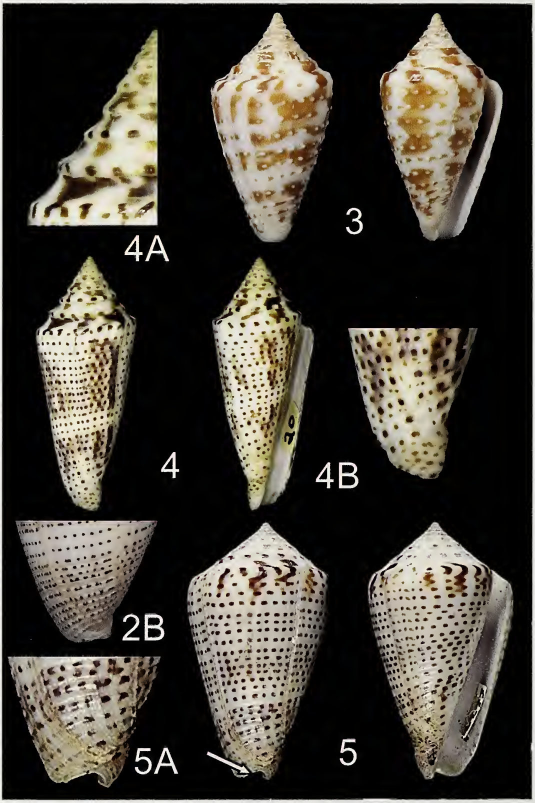


Figure 2. Three related species of Conilithinae from the East Pacific. Figure 2(3). Specimen of *Globiconus baccatus*, 23.3 mm shell length, from Golfo de Chiriqui, Panama MJT collection. Figure 2(4). Specimen of *Globiconus tornatus*, 38.1 mm shell length, dredged off Cabo San Lucas, Mexico, INHS 44502. The scalariform spire is shown in Fig. 4A and the absence of an anterior notch at the anterior end in Fig. 4B. Figure 2(5). Specimen of *Perplexiconus perplexus*, 31.4 mm shell length, from Isla Santa Clara, Mexico INHS 44742. Arrow points to the pronounced anterior notch located at the anterior end of the shell of *P. perplexus*. The anterior notch is enlarged in Fig. 5A. This structure is only well developed in *Perplexiconus*.

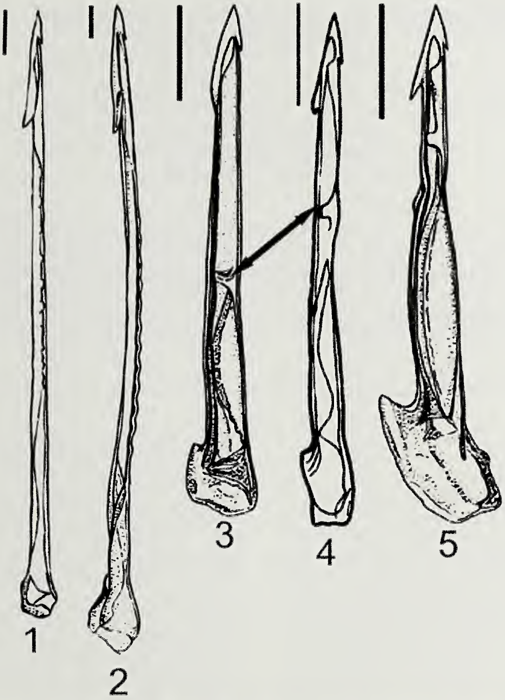


Figure 3. Drawings of the radular teeth of various spotted cones from the East Pacific all belonging to Conilithinae. All drawings were previously published by Tenorio *et al.*, 2012 or by Tucker & Tenorio, 2013. Drawings vary in scale. *See* Tenorio *et al.*, 2012 for further information on sources and citations. Genus ***Ximeniconus*** Emerson & Old, 1962. Figure 3(1). *Ximeniconus mahogani* (Reeve, 1843). Sonora, Mexico. Specimen SBMNH 424126. Tooth Length (TL) = 1.07 mm; Shell Length (SL) = 38.5 mm; drawing from Tucker & Tenorio, 2009, pl. XV, fig. 10. Figure 3(2). *Ximeniconus ximenes* (J. E. Gray, 1839). Golfo de Panama. TL = 1.37 mm; SL = 45.2 mm, drawing from Tucker & Tenorio, 2009, pl. XV, fig. 9. Genus ***Globiconus*** Tucker & Tenorio, 2009. Figure 3(3). *Globiconus baccatus* (G. B. Sowerby III, 1877). Specimen SBMNH 150658, Islas Secas, Golfo de Chiriqui, Panama. TL = 0.54 mm; SL = 21 mm, drawing from Tenorio *et al.*, 2012, pl. 1, fig. 1. Figure 3(4). *Globiconus tornatus* (G. B. Sowerby I, 1833). Gulf of Panama. TL = 0.5 mm; SL = 21.9 mm, drawing from Tucker & Tenorio, 2009, pl. XIII, fig. 22. Arrow points to the internal tubular structure characteristic of *Globiconus* found in the radula tooth of *G. tornatus* and *G. baccatus*. Genus ***Perplexiconus*** Tucker & Tenorio, 2009 Figure 3(5). *Perplexiconus perplexus* (G. B. Sowerby II, 1857). Specimen SBMNH 150818, Sonora, Mexico. TL = 0.45 mm; SL = 27 mm, drawing from Tucker & Tenorio, 2013, p. 27.

ISSN 0738-9388

A New Species of *Miliariconus* Tucker and Tenorio, 2009 (Conidae: Puncticulinae) from the Northern Red Sea

Edward J. Petuch[1] and David P. Berschauer[2]
[1] Department of Geosciences, Florida Atlantic University, Boca Raton, Florida 33431
epetuch@fau.edu
[2] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com

ABSTRACT A new shallow water, coral reef-dwelling cone shell of the genus *Miliariconus* Tucker and Tenorio, 2009 is described from the Sinai Peninsula and Gulf of Aqaba (Gulf of Elat) of Egypt and Israel. The new species, *Miliariconus sinaiensis*, is most similar, especially in color pattern, to *M. fulgetrum* from Japan and the Ryukyu Islands of the northwestern Pacific, but differs in being a smaller and smoother shell with less-developed shoulder knobs, and in having a base shell color of bright pink or salmon pink. The new Red Sea cone is endemic to the southern Gulf of Suez, the coast of the Sinai Peninsula, and to the Gulf of Aqaba.

KEY WORDS Conidae, *Miliariconus*, Red Sea, Sinai Peninsula, Gulf of Aqaba, Gulf of Elat, Egypt, Israel.

INTRODUCTION

The expansion of global tourism during the early 21st Century has resulted in greatly-improved travel conditions to previously-inaccessible tropical and subtropical areas around the world. One of the most understudied of these newly-available venues is the Sinai Peninsula and Gulf of Aqaba (Gulf of Elat) of the northern Red Sea. In response to the demands of an ever-increasing population of tourists, many new resorts have been built in the cities of Sharm el-Sheikh (Egypt) and Elat (Israel) and these have acted as "base camps" for divers and exploratory conchologists. The Egyptian and Israeli beach resorts have allowed shell-collecting divers to have access to many previously-unexplored marine habitats, in particular the shallow fringing reefs that line the southern Sinai Peninsula. Within these extensive reef complexes, a large resident fauna of cone shells occurs, with at least 15 species and subspecies of the family Conidae, several of which are endemic to the area. Some of the endemic taxa, such as *Calamiconus quercinus akabensis*, *Cylinder textile neovicarius*, *Harmoniconus sharmiensis*, and *Pionoconus nigropunctatus elatensis* are eagerly sought after by shell collectors and are also considered to be of special interest to marine biogeographers and evolutionary biologists.

The Gulf of Aqaba (which is referred to as the Gulf of Elat by the Israelis) is a shallow, elongated bay that originated as an ancillary rift valley off the main Red Sea Rift System (Ben-Avraham, 1985). Having formed during the late Oligocene and early Miocene Epochs, this narrow, fjord-like body of sea water has had several episodes of altered oceanographic conditions, varying from high salinity- high productivity conditions to normal salinity-low productivity conditions (Reiss, 2012). These fluctuating water chemistries resulted from oscillating sea levels during the late Pliocene and Pleistocene Epochs (glacioeustatic fluctuations) and from tectonic uplifts of

sections of the Gulf region. In the early Pleistocene, during severe glacial build-up in the Northern Hemisphere, the surface level of the Red Sea dropped sufficiently to cause the shallow sill at the mouth of the Gulf of Aqaba to become emergent. This narrow land barrier effectively isolated the Gulf and transformed it into a large salt water lake that was cut off from the Red Sea. During this time of oceanographic sequestration, populations of cone shells trapped within the Aqaban salt water lake would have become genetically-isolated from their parent populations in the Red Sea and would have undergone rapid speciation, due primarily to the Founder Effect. The Red Sea, itself, underwent similar episodes of oceanographic sequestration during Pleistocene sea level fluctuations, leading to the evolution of the rich endemic molluscan fauna of the Recent Eritrean Molluscan Province.

As sea level rose during the late Pleistocene, the exposed land barrier at the mouth of the Gulf would have become submerged with sea water and the Gulf of Aqaba would again have reconnected to the main Red Sea Basin. Possibly due to ecological competition with congeners, many of the newly-evolved Aqaban and Sinai Peninsula endemics remained close to their center of evolution and did not disperse southward into the main body of the Red Sea. One of these is a small, shallow water cone shell that has been referred to as either the wide-ranging Indo-Pacific taxon "*Miliariconus miliaris*" or to the Japanese endemic "*Miliariconus fulgetrum*" by many workers over the past century. Close examination shows that this small cone, although similar to the true *M. miliaris* and to *M. fulgetrum*, consistently differs in many shell characters and represents a previously-overlooked species. The holotype is deposited in the molluscan type collection of the Department of Malacology, Los Angeles County Museum of Natural History, Los Angeles, California, and bears an LACM number. The new Red Sea *Miliariconus* is described here.

SYSTEMATICS

Class Gastropoda
Subclass Sorbeoconcha
Order Prosobranchia
Infraorder Neogastropoda
Superfamily Conoidea
Family Conidae
Subfamily Puncticulinae
Genus *Miliariconus* Tucker and Tenorio, 2009

Miliariconus sinaiensis Petuch and Berschauer, new species (Figure 1E-H)

Description: Shell of average size for genus, inflated, stocky, vasiform, turbinate, with distinctly rounded sides; spire proportionally low, broadly subpyramidal; shoulder and spire whorls ornamented with 10-12 large, rounded knobs; body whorl smooth and shiny, ornamented with 10-12 faintly incised grooves on anterior half of some specimens (such as holotype, Plate 1E, F); anterior end and siphonal area ornamented with 6 proportionally large and conspicuous spiral cords; body whorl base color pale pink or salmon-pink, overlaid by 2 large wide bands of dark pinkish-rose or pinkish-tan, one around mid-body and one around anterior end, with color bands separated by wide white band around mid-body; body whorl color bands overlaid with numerous tan spiral lines and large obliquely-angled thin white flammules, arranged in zig-zag chevron pattern; anterior tip of shell white or pale yellow-white; large cords around anterior end marked with alternating white and tan spots; spire whorls and shoulder knobs white, with large reddish-tan elongated patch present between shoulder knobs; aperture proportionally narrow; interior of aperture white, with 2 large dark pinkish-tan patches that

correspond to dark body whorl bands; periostracum thin, adherent, dark yellow-tan.

Type Material: Holotype: length 22.1 mm, on coral rubble, 1 m depth, off Elat, Israel, Gulf of Aqaba (Gulf of Elat), Red Sea (Plate 1E, F) (LACM 3350). **Other Study Material:** length 28.2 mm, 1 m depth on exposed coral rubble, off Sharm el-Sheikh, South Sinai Governorate, southern Sinai Peninsula, Egypt, research collection of E.J. Petuch (Figure 1G, H); length 27.5 mm, on coral rubble, 1 m depth, off Elat, Israel, research collection of E.J. Petuch; length 27.8 mm, exposed at low tide, on reef flat off Hurghada, Egypt, research collection of D.P. Berschauer.

Type Locality: Northernmost Gulf of Aqaba (Gulf of Elat), Red Sea, exposed on coral rubble in 1 m depth, off Elat, Israel.

Distribution: The new species is endemic to the northern Red Sea, where it ranges from the southern Gulf of Suez, along the entire Sinai Peninsula, and throughout the entire Gulf of Aqaba (Gulf of Elat).

Ecology: *Miliariconus sinaiensis* inhabits coral rubble areas and exposed reef platforms, from the low tide mark to depths of 5 m.

Etymology: The new species is named for the Sinai Peninsula of Egypt, which is the biogeographical center of distribution for this endemic cone shell.

DISCUSSION

Of the 11 known species of *Miliariconus*, the new species most closely resembles *M. fulgetrum* (Sowerby I, 1834) from Japan and the Ryukyu Islands of the northwestern Pacific (Figure 1C, D). Both the Japanese and the Eritrean species share a color pattern of obliquely-angled chevrons that are arranged in a network of prominent zig-zags flammules. Indeed, the similar patterns of zig-zag "lightning" markings have led some cone workers and shell dealers to consider *M. fulgetrum* and *M. sinaiensis* to be conspecific, without considering that no *fulgetrum*-type cones are found anywhere in the vast area between Japan and the Red Sea. The similarity of color patterns is only superficial, as the "lightning pattern" of *M. fulgetrum* is better-defined and breaks up into numerous small flecks and dots that cover most of the body whorl. The "lightning" zig-zag flammules seen on *M. sinaiensis* are proportionally larger and more cohesive and do not break up into small dots and flecks. The Japanese *M. fulgetrum* is also a more darkly-colored shell, having a base color of dark reddish-brown and lacking any of the pink and salmon-pink colors of the new Red Sea species. *Miliariconus fulgetrum* is also a more elongated and cylindrical shell with proportionally much larger and more rounded shoulder knobs. Because there has been some confusion over the conspecificity of *M. fulgetrum* and *M. sinaiensis* and the type locality of *M. fulgetrum* (Filmer, 2012), we here designate the type locality of *M. fulgetrum* as "Tean Bay, Amami Oshima Island, northern Ryukyu Islands, Japan" (based on specimens collected in Tean Bay, in November, 1974, by the senior author; one illustrated here on Figure 1C, D). We consider *M. fulgetrum* and *M. sinaiensis* to be separate, distinct species.

The new Red Sea cone is also similar to the wide-ranging Indo-Pacific *Miliariconus miliaris* (Hwass, 1792) (found from southeastern Africa to Polynesia; Figure 1A, B), but differs in being a smaller, stockier, and more colorful shell with proportionally smaller and less-developed shoulder knobs. Although some specimens of *M. miliaris* have a pattern of white zig-zag flammules on a pink background (as seen here

on Figure 1A, B), this "lightning" configuration is never as well-defined nor as well-developed as that seen on *M. sinaiensis*. *Miliariconus miliaris* also is a much more heavily-sculptured shell than either *M. fulgetrum* or *M. sinaiensis*, having large, prominent beaded cords running around the anterior half of the body whorl. The wide-ranging *M. miliaris*, extending from East Africa to Polynesia, is most probably the ancestor of both *M. fulgetrum* and *M. sinaiensis*. Along the Egyptian coast near Hurghada, the new species occurs sympatrically with the widespread Eritrean Molluscan Province congener *M. taeniatus* (Hwass, 1792), but appears to be less common. With the discovery of the new northern Red Sea species, the genus *Miliariconus* is now know to contain 11 species. These include:

Miliariconus abbreviatus (Reeve, 1843) (endemic to the Hawaiian Islands)
Miliariconus aristophanes (Sowerby I, 1857) Philippines, Melanesia, and Polynesia)
Miliariconus coronatus (Gmelin, 1791) (widespread Indo-Pacific)
Miliariconus encaustus (Kiener, 1845) (endemic to the Marquesas Islands)
Miliariconus fulgetrum (Sowerby I, 1834) (endemic to Japan and the Ryukyu Islands)
Miliariconus miliaris (Hwass, 1792) (southeastern Africa to Polynesia)
Miliariconus pascuensis (Rehder, 1980) (endemic to Easter Island)
Miliariconus roosevelti (Bartsch and Rehder, 1939) (endemic to Clipperton Island)
Miliariconus sinaiensis Petuch and Berschauer, new species (endemic to the northern Red Sea)
Miliariconus taeniatus (Hwass, 1792) (Red Sea and coast of Oman)
Miliariconus tiaratus (Sowerby I, 1833) (Gulf of California to the Galapagos)

It is interesting to note that, of the 11 known species, only five (*aristophanes*, *coronatus*, *miliaris*, *taeniatus*, and *tiaratus*) have wide geographical ranges. The other six congeners (*abbreviatus*, *encaustus*, *fulgetrum*, *pascuensis*, *roosevelti*, and *sinaiensis*) all are restricted to small geographical areas or isolated islands. This indicates that members of the genus can readily lose their planktotrophic larval stage and utilize direct development and low dispersibility (vagility) as a reproductive strategy. By having evolved inside the isolated Aqaban salt water lake during the Pleistocene, *Miliariconus sinaiensis* lost its ability to disperse and spread elsewhere throughout the central and southern Red Sea and it remains confined to its center of origin.

REFERENCES

Ben-Avraham, Zvi. 1985. Structural Framework of the Gulf of Elat (Aqaba), Northern Red Sea. *Journal of Geophysical Research* 90 (1B):703-726.

Filmer, M. 2012. Illustrated List of Cone Taxa and Holotypes. *Cone Collector Website.* www.theconecollector.com

Reiss, Zeev. 2012. *The Gulf of Aqaba: Ecological Micropaleontology.* Springer Publishing Company (Science and Business Media), New York and the Netherlands. 356 pp.

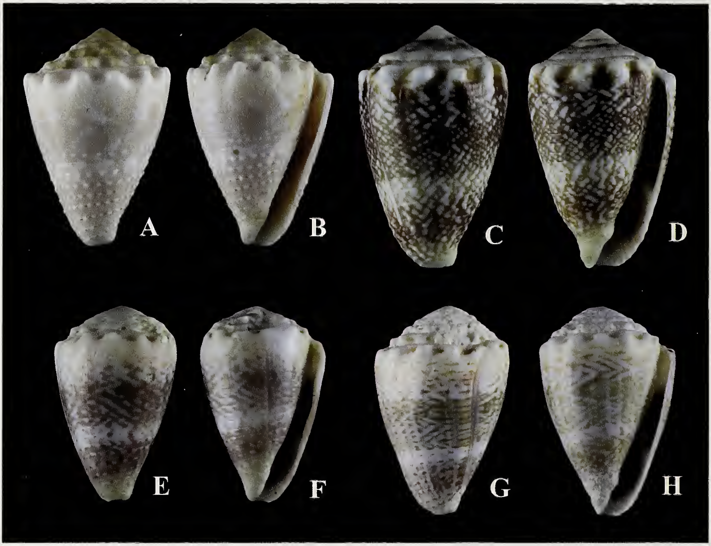


Figure 1. Species of *Miliariconus* Tucker and Tenorio, 2009 from the South Pacific, Japan, and the Red Sea. Images: A, B= *Miliariconus miliaris* (Hwass, 1792) (Type of the genus *Miliariconus*). Length 29.4 mm, found in coral rubble, 1 m depth off Chapman Island, Great Barrier Reef, northern Queensland, Australia. In the research collection of E.J. Petuch. **C, D=** *Miliariconus fulgetrum* (Sowerby I, 1834). Length 32.3 mm. Found in sand and coral rubble, 1 m depth on main reef off Tean Bay, Amami Oshima Island, northern Ryukyu Islands, Japan. In the research collection of E.J. Petuch. **E, F=** *Miliariconus sinaiensis* Petuch and Berschauer, new species. Holotype, length 22.1 mm, LACM 3350. In coral rubble, 1 m depth off Elat, Israel, Gulf of Aqaba, Red Sea. **G, H=** *Miliariconus sinaiensis* Petuch and Berschauer, new species. Length 28.2 mm, found on exposed coral rubble bottom, in 1 m depth, off Sharm el-Sheikh, South Sinai Governorate, southern Sinai Peninsula, Egypt. In the research collection of E.J. Petuch.

ISSN 0738-9388

Have a shell collection you would like to donate or devise?

The San Diego Shell Club is interested in high quality estate shell collections. As a 501c(3) organization all donations to our Club may provide a tax write-off. When we receive a donation we carefully record each item and provide a letter describing the items for use when filing your taxes. While we cannot provide a value, donations of up to $5,000 do not require a written appraisal. Since tax laws change regularly we recommend that you check with your tax accountant before relying on any information provided in this paragraph. We are interested in all types of shells, marine or land and all genera and species, books on shells as well as items related to shells such as artwork, storage cases and tools. Your items will be used to generate income to support the Club's efforts in continuing Public education about shells and conservation of marine life throughout the world. If you would like to donate, please contact Dave Waller, SDSC Acquisition Chairperson, at dwaller@dbwipmg.com to schedule a time to discuss charitable gifting.

CLUB NEWS

May 21-22, 2016 - West Coast Shell Show

- In lieu of regular meeting. See article on p. 204

June 18, 2016, Regular Meeting, 751 Raintree Drive, Carlsbad, CA

- Meeting called to order at 12:15 p.m.
- Pizza and soda were provided
- Speaker Bill Schramm gave a presentation on Cowries, with specimen shells for viewing
- Treasurer's report was given
- Editors report was given
- Shells and books were displayed and shells were offered for sale via silent auction
- David Berschauer gave a brief talk on Sinstral gastropods
- Meeting adjourned at 2:10 p.m.

July 16, 2016 - Shell Bazaar

- A social meeting of members at the home of Rick and Cheryl Negus in Carlsbad
  — Cancelled due to an unexpected funeral

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 3

Olive Shells Don't Care What You Call Them

Richard L. Goldberg
Worldwideconchology.com
worldwide@rcn.com

Let's face it, taxonomy, the science of describing, identifying, naming, and classifying living things, is a manmade construct that since the mid-1700's when Carolus Linnaeus introduced his system of binomial nomenclature, has evolved into a highly sophisticated and often contentious science. Genera, subgenera, species, subspecies, form names, etc. applied to living things are introduced and delivered through printed (and now even electronic) publications, all conforming to a tight and tidy group of rules and regulations administered by the International Commission on Zoological Nomenclature (ICZN). The ICZN determine, to a greater extent, the validity of the species and its description.

Taxonomy is good for satisfying the human need to organize and categorize living things and allow museums, naturalists and collectors to sort and display their collections systematically while providing a consistent way to make identifications; "almost" everyone is on the same page, so-to-speak. If, in the case of malacological taxonomy, the mollusca who are being classified and categorized understood the trials and tribulations that scientists have gone through to create such a system for naming and organizing their phylum, I'm sure they would be overwhelmingly impressed! The fact is, they don't know and they just don't care! And the reason might not be as obvious as you think.

The practice of naming species forms seems to be a plausible pursuit; many species show tremendous variation from location to location and even within individual populations. Shells in the genus *Oliva*, the Olive shells, are just one of those groups that display tremendous variation within a species. If a form is given a name, everyone should know what you are talking about when you reference the name in conversation or writing; that is, if the shell stays true to its color-pattern for which many of these forms are described and named.

Conventional wisdom might say the color and pattern of a mollusk is consistent throughout the growth of its shell. The fact is conventional wisdom has little to no bearing on molluscan morphology and presumably even less on the [early artificial, natural and then evolutionary] sciences of taxonomy!

Take for instance, *Oliva carneola*, a common shallow water species found throughout the Western Pacific. Numerous form names have been applied to many of the "*carneola*" variations. Some were originally described as full species until it was determined at a later date to only be a form of *O. carneola*; in-other-words, described at a date after 1798 when Johann Friedrich Gmelin described *Voluta carneolus* (= *Oliva carneola*).

Figure 1 illustrates a series of *Oliva carneola* from one population collected in the late 1950's from Mindoro Island, Philippines by Pedro De Mesa, a Filipino shell dealer and naturalist. De Mesa was

ISSN 0738-9388

instrumental in supplying many undescribed and long lost species from the Philippines to malacologists and collectors before the heyday of modern molluscan discovery in the archipelago that began in the late 1960's and continues through today.

FIGURE 1: *Oliva carneola* (Gmelin, 1791) various forms from Mindoro Island, Philippines. (top row) *O. carneola*, form: *adspersa* Dautzenberg, 1927 – all under 15 mm. (bottom row left-to-right) *O. carneola*, forma *trichroma* Dautzenberg, 1927 – 25 mm; three specimens (arrows) pointing to abrupt changes in pattern of shells from the adspersa form to a more typical orange-banded *O. carneola* form; one specimen changed a third time to a pattern-less all white shell.

It's surprising (or, maybe not) that many of the specimens from this *Oliva carneola* population (and no doubt others too) start out growing with one "named" color and pattern and then abruptly change the color and pattern as the mollusk continues to enlarge its shell. The smallest shells of this group are all covered with a diffuse netted pattern of tents; a form described as *O. carneola* forma *adspersa* Dautzenberg, 1927. As all of the shells in this population approach ± 15mm the patterns completely changed to a more typical *O. carneola* pattern with diffuse bands of orange and white, and some even approaching another color form that Dautzenberg named *trichroma*.

ISSN 0738-9388

Inquisitive minds might ask whether this phenomenon is genetically or environmentally induced. The latter is referred to as Phenotypic Plasticity, the ability of a species to change its visible look or morphology in response to environmental changes. Phenotypic Plasticity is often seen on the patterns of various Cone shell species (Figure 2) where the shell starts out with one color and pattern and then abruptly changes.

FIGURE 2: Color-Pattern Changes in *Conus*. 1.) *Conus regius* Gmelin, 1791 form: *citrinus* Gmelin, 1791 – with a sudden change to a typical *C. regius* pattern. 2.) *Conus striatellus* Link, 1807 – showing a period of growth with no pigment. 3.) *Conus amadis* Gmelin, 1791, form: neptunus Kiener, 1843 – changes back to a typical *C. amadis castaneofasciatus* color-pattern for a short period. 4.) *Conus floccatus* Sowerby I, 1841 – started growth with a very sparse pattern that changes quickly to a darker and more complex pattern. 5.) *Conus aulicus* Linnaeus, 1758 – most of the growth of this shell has a typical aulicus pattern; the color-pattern changes drastically on the last third of the body whorl. 6.) *Conus princeps* Linnaeus, 1758 - an abrupt change from a typical princeps pattern to one that is lighter in color and with only sparse axial lines through to the end of its growth. 7.) *Conus generalis* Linnaeus, 1767 – shows typical a bright orange color for the early part of the body whorl growth and then changes to a dark brown black color for the majority of the body whorl growth.

ISSN 0738-9388

In the case of the Mindoro *Oliva carneola*, all of the mollusks in this population might have been living an area of the ocean where there was a sudden change in the temperature, food supply or even water chemistry. The stimulus might have caused the entire population to simultaneously secrete pigments differently at this one moment in time since all of the shells were collected at the same time so the changes seem to have affected all of the shells. Other questions such as whether this is a common occurrence for the species are relevant to better understanding why this change in color and pattern occurs. It has been shown that change in diet of *Haliotis*, the Abalone, alters the creation of color and pattern of their shells. Why not then for other mollusks like *Oliva*?

On the flipside, it has been pointed out by collectors that the netted patterned *Oliva carneola* form *adspera* are always small; under 20 mm. Could then the *adspersa* form of *Oliva carneola* just be small, immature *Oliva carneola* without a characteristic adult orange coloration? A larger study series from various populations might reveal more about this observation of sudden pattern changes in *Oliva carneola*; it may be that all *Oliva carneola* start out growing with a netted pattern and then alter their pigment output at a certain point in growth; then a genetic influence.

My tongue-in-cheek premise that mollusks don't care what you call them might also apply to the ol' taxonomic name game; no matter what you call a shell, there is no guarantee that the name will continue to apply as the shell grows – dashed by Phenotypic Plasticity [or genetics]! Sure, a mollusk doesn't care what you call it, I guess as long as you don't call it late for dinner!

FIGURE 3: Stark Change - This specimen that conforms to the description of Oliva miniacea miniacea (Röding, 1798) form: sylvia Duclos, 1845. This Philippines specimen is 56 mm in length. Looking at the edge-wise pattern from the spire whorls the shell grew with a consistent pattern until the last third of the body whorl. The mollusk suddenly and seemingly without warning stopped laying down pigment leaving a mostly white shell for the last portion of the shell. There is no gradual change. Viewed from the spire there also seems to be no damage during growth that might have caused damage preventing the mollusk from creating pigment. It would seem then the sudden change was caused by an environmental stimuli. Temperature, water chemistry or a change in food source might have instigated this sudden pattern change.

ISSN 0738-9388

Red Abalone Out Plant Project

Arjay Raffety
13214 Fiji Way, Unit A, Marina del Rey, California 90292
JArjayR@aol.com

ABSTRACT During a three week period within January of 2016, the author supported an effort to out plant farm-raised red abalone (*Haliotis rufescens*) in southern California. This work serves two main objectives. The first is to enhance red abalone populations along the southern California mainland coast where they were once plentiful. The second is to provide a 'warm up' exercise and study for the day when the endangered white abalone (*Haliotis sorenseni*) will be reintroduced through out planting into its native range where it has become functionally extinct. What follows is an account of this activity.

INTRODUCTION: There are seven species of abalone that exist along the coast of California with common names red, pink (or corrugated), white, green, black, flat, and pinto/threaded. Due mainly to overfishing and other compounding environmental factors, the populations of abalone in southern California dropped so far as to no longer be able to sustain a fishery. In 1997 the abalone fishery south of San Francisco was closed (both commercial and sport). Careful monitoring and reductions in allowable catch when needed has enabled the fishery north of San Francisco to remain open, though solely for sport harvest and of only red abalone (*Haliotis rufescens*). The moratorium has been crucial in assuring that the northern fishery does not go the way of the southern fishery.
The most impacted of the southern California abalone fisheries was the white abalone (*Haliotis sorenseni*), which can be found in southern CA and Mexico. The white abalone was the first marine invertebrate to be placed on the endangered species list. Eventually the black abalone (*Haliotis cracherodii*) followed suit and this was in part due to 'withering syndrome' which is a disease that afflicts abalone particularly in warm water conditions.

Today, two of the seven California abalone species are on the US Endangered Species List. There is a moratorium of harvesting south of San Francisco, and although it is the most successful abalone fishery in the world, the carefully monitored red abalone fishery in northern California continues to undergo a reduction to bag limits. The state of California's abalone populations is at a turning point and this is why the author decided to volunteer his scientific diving skills to help monitor stocks and assist with restoration. The goal is to help restore the fisheries so hopefully future generations will continue to enjoy harvesting and eating abalone.

Thankfully, restoration seems to be a hopeful prospect for California's abalone. Through a collaborative effort between UC Davis, CDFW, NOAA and several of California's public aquaria, a captive breeding program at UC Davis's Bodega Marine Laboratory has been very successful at breeding and raising white abalone. The majority of the white abalone's habitat remains intact, which makes reintroduction a tangible prospect. And since marine farms and laboratories have been propagating abalone for years, there is a significant knowledge base to draw from. There may now be more juvenile white abalone growing in laboratory tanks than exist in the wild. Given this success, the sooner the farm-raised stock is introduced to the wild, the sooner the ocean populations may

ISSN 0738-9388

recover. Abalone become more labor and resource-intensive to keep in captivity so out planting is also necessary to keep expenses of the program in check. But the out planting needs to be done in a way that assures some of the abalone survive and grow to reproduce. Scientists have to perform careful site assessments to minimize the risks the out planted abalone will face and to ensure that they are not just thrown into predator-laden or unsuitable waters.

DISCUSSION: In order to manage a population successfully, it is necessary to understand the reproductive capacity of that population. In order to assess the reproduction of different abalone species within California, CDFW has maintained artificial reef like structures in northern and southern California. These structures are called Abalone Recruitment Modules (ARMs) in the north and Baby Abalone Recruitment Traps (BARTs) in the south, which are fondly termed "abalone condominiums". (*see* Figure 1) They consist of a cage filled with cinder blocks intended to provide a refuge particularly for small abalone. These ARMS and BARTS are surveyed often and the baby abalone living within them provide clues as to the reproduction of the species as a whole. The author has helped survey these 'abalone condominiums' many times and it consists of opening the cage and carefully removing the cinder blocks to reveal all the critters that tend to inhabit them and there are many: urchins, octopus, whelks, stars, cowries, crabs, shrimp, *etc.* Northern California surveys tend to reveal a handful of young abalone that are either reds, flats, or pintos. Southern California surveys reveal only a few young abalone and they tend to be greens, pinks, and sometimes reds. No white abalone juveniles have ever been found inside of these BARTs. While the abalone fishery is still in pretty good condition in the north, recovery is still slow to take place in the south for most of the species (note that all 7 species can be found in Southern California).

While there is more to learn about the effectiveness of these abalone condominiums in assessing abalone recruitment, part of this red abalone out plant study is to assess if they can be used successfully as a basis for monitoring whether an out planting will be effective. Given these condominiums already exist in various places in California, the thought is that they would be good initial homes and refuges for out planted abalone.

Many factors went in to deciding where to place the abalone condominiums. The first is that they need to be set on reef (not sand) where abalone can cling and move around if necessary. They need to be placed in habitat where there is food. Abalone graze on various algal species that grow on the substrate/reef. The types of kelp they eat vary along the California coastline. Kelp availability is also influenced seasonally by ocean conditions, as winter storm swells and surges can denude areas of certain types of kelp that require time to recover. An ideal place to locate the condominiums is in areas where abalone have been historically present (as indicated by previous commercial landing information) showing necessary habitat conditions exist (rock substrate, food, places to hide from predators, cool enough water, *etc.*).

The project at hand used 12 existing BARTs sitting on the ocean floor across 3 sites along mainland coastal southern California. A sampling of the abalone used in the study were immediately sacrificed for testing to assure they were free of any non-endemic pathogens or pests that can afflict abalone, like sabellid worms. A total of 3200 abalone were out planted, 1600 at one location, 1600 at another, and none at the third which represents a 'control' condition.

ISSN 0738-9388

Figure 1. BART on rocky reef ocean floor (Photo Credit: Athena Maguire)

Before any out planting took place, sites where the BART clusters were located required preparation. On the first few dive days, the objective was to lay out four 20 meter lines on the ocean floor. One line ran North-South, another East-West, another NW-SE, and another NE-SW. This configuration had a central 'hub' and formed eight sectors or wedges that were well defined and could be monitored for months to follow. Laying the lines out was challenging because long period swells were coming through which stirred up the bottom and caused surge even 70 feet down on the ocean floor. Anchoring the lines was also challenging but facilitated by pounding railroad spikes into cracks in the reef. (*see* Figure 2) The lines were then zip-tied to the spike anchors. This project does assume the sites will need maintenance as some spikes could dislodge in rough ocean conditions as well as slowly erode in the salt water.

Once all the lines were anchored on the bottom in a glorified asterisk pattern (* but with 8 rays off the hub rather than 6), the BARTs were moved with lift bags and placed near the hub. In order to give the abalone more of a chance to survive, predators except fish were gathered and relocated at least a mile away from the sites. Abalone have many predators beyond humans – sea stars, whelks, octopus, fish, crabs, lobsters, *etc.* (*see* Figures 3-5) Though sea otters are significant predators of abalone and other shellfish, there are currently none observed in the area of the out plant. Abalone also have competitors for food – mostly sea urchins.

Figure 2. Shelby Kawana anchoring spike into reef (Photo Credit: Athena Maguire)

Figures 3, 4, and 5. Predators: Left: Kellet's Whelk, Middle: Octopus, Right: Sheephead Fish (Photo Credits: Athena Maguire)

There were several other activities performed at each of the study locations. The types of algae on the substrate along the lines were recorded. Also, the 'rugosity' of the lines was measured. The 20 meter anchored lines did not truly stretch 20 linear meters because the ocean floor in these areas is not flat -- it is reef with boulders which provide a topography. The linear distance from the hub of each draped line was measured and that is called rugosity. Also at these sites the different types of fish were assessed as some (particularly sheephead, *see* Figure 5) will vacuum little abalone right off the reef, digest the animal, and then regurgitate the shell which then appears different because it is etched by stomach acid.(*see* Figure 11)

Three PVC-like tubes containing 100 one-inch abalone were placed within each BART and two more PVC-like tubes containing 50 two-inch abalone were attached outside each BART. (*see* Figure 6) So each BART received 400 juvenile abalone within tubes that were bungee-corded shut with a zinc fastener that would erode and release the end-covers of the tubes after roughly eight hours. The eight hour delay was to ensure the abalone were released at night when there are fewer predators around. Two different sizes of abalone were purposefully chosen in order to try to determine if survival rate differs with size.

Figure 6. Tagged abalone in tube at Aquarium of the Pacific (Photo Credit: Athena Maguire)

The 8 BARTs which contained 5 tubes each were surveyed the very next day to see what happened. Some abalone had stayed put in the tubes, some had migrated into the bricks within the BARTS, and some had migrated out onto the reef. (*see* Figures 7-9) During that observation, only a handful of empty shells were found near the BARTs and these were abalone that had succumbed to predators as evidenced by damage to the shell like chips on the growing margin or a drill hole (this is how whelks and octopus sometimes take shellfish). During these dives, if predators were found that had moved into the study area or perhaps had not been seen during initial searches, they were gathered and relocated as before.



Figures 7, 8 and 9. Left: Abalone clustered within cinder blocks in a BART, Middle: Abalone on cinder block on outside of cage, Right: Abalone that migrated onto reef (Photo Credits: Athena Maguire)

The following links contain time lapse video produced by Bill Hagey of the release of the abalone from the PVC tubes at just one of the BARTs used for out planting:
https://youtu.be/HzrMiRoeCWQ
https://youtu.be/vMZvKEr9iQE

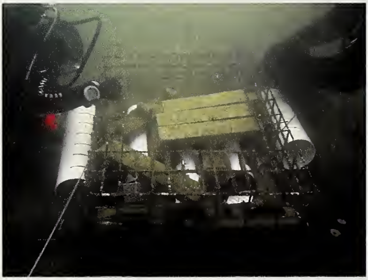


Figure 10. Divers removing empty tubes after out plant (Photo Credit: Athena Maguire)

Figure 11. Shells: silvery one digested/regurgitated by fish (Photo Credit: Captain Chuck Wagon)

Within a week the cages were revisited with the primary purpose of collecting the PVC-like tubes. (*see* Figure 10) At this point almost all of the abalone had migrated out of the tubes and onto the BART bricks or nearby reef. All of the out planted abalone had been tagged with a number sequence

ISSN 0738-9388

and the divers recorded the sequences of all of the abalone that could be seen. No invasive searching was performed, meaning no turnover of rocks in the vicinity or removal of bricks from the BARTs. Empty shells were collected and perhaps 10% of the out plant had already been located as just shells. Some shells were found beyond the asterisk of anchored grid lines (this could have been due to a predator moving their catch or the significant surge on the bottom experienced on dive days when there were long-period large swells). Predators found during these surveys were again relocated as originally stated.

Scientific diving personnel from various organizations will continue surveying these sites regularly for the foreseeable future. The hope is to continue to find tagged abalone alive at these sites and measure their growth and survival. The primary purpose of this project is to enhance local red abalone populations while learning more about the behavior and post-out planting dynamics of abalone and their ecosystem.

CONCLUSION: Three weeks of intensive diving prepared sites on the ocean floor for out plant of red abalone. 3200 farm-raised and disease-free juvenile red abalone were out planted and after one week, the majority of them likely survived. Continued monitoring will take place to assess the progress of the study. Any conclusions drawn from this study will influence how, when, and where juvenile red and endangered white abalone will be out planted to conduct abalone restoration in southern California.

For more information: Laura Rogers-Bennett, California Department of Fish and Wildlife (email: laura.rogers-bennett@wildlife.ca.gov)

About the author:

Arjay Raffety worked in the aerospace industry for 20 years on Guidance, Navigation, and Control Systems of satellites. In 2009, he walked away from that career to see his parents through to their peaceful ends. While tending to his father in his final years, Arjay began to pursue his interest in marine biology; that interest was sparked by his father who took him to tide pools while a child. Arjay has been a certified SCUBA diver since 1990 and was a free-diver before then. In 2012, he went through the scientific diving training program with the California Department of Fish and Wildlife (CDFW) which allowed him to assist with studies they conduct. His main focus is on abalone research and restoration. He has a formidable abalone shell collection that spans the globe and contains almost all species, subspecies, and forms.

ISSN 0738-9388

Attack Behavior of the King Helmet *Cassis tuberosa* and Avoidance Behavior of the Long-Spine Sea Urchin *Diadema antillarum*

Paul Tuskes
3808 Sioux Ave, San Diego, California 92117
tuskes@aol.com

ABSTACT Predation by the King Helmet *Cassis tuberosa* was observed and documented on the Long-spine sea urchin, *Diadema antillarum* at Cayman Brac. Long-spine urchins are very mobile and successful attacks occurred when the habitat was not optimal for the escaping urchin. Two different modes of attack were documented and the speed of the Long-spine urchins exhibiting flight-response was estimated at 1 cm per second while on a flat hard surface.

INTRODUCTION

The general preference for sea urchins as prey species of Western Atlantic *Cassis* is well known. Two frequently cited papers are Moore 1956 and Gerace & Lindsay 1992. Both papers focused on the Queen Helmet *Cassis madagascariensis* Lamarck 1822 with regard to prey selection; mention of the King Helmet *Cassis tuberosa* (L. 1758) is made but the details of its feeding behavior is not discussed. In laboratory studies Gerace & Lindsey 1992 offered many species of live urchins as food, and recorded preferences for both species of *Cassis*. During their study no long-spine urchins *Diadema antillarum* Philippi 1845 were consumed by either species of *Cassis*; they remarked about the speed and sensitivity of the *Diadema* to the *Cassis*. The long-spine urchin is usually associated with hard substrate, while these *Cassis* are often found in extensive areas of sand. The field observations reported in this short paper represents predator-prey behavior under natural conditions.

OBSERVATIONS

In late November 2015 I spent a week diving off Cayman Brac and Little Cayman islands. The daily routine started with Bonine prior to a small breakfast, and off to the boat for a wall dive, followed by a shallower dive. Then we went back for a late lunch and free time, which for me was spent snorkeling in the lagoon. While snorkeling I observed a mature King Helmet *Cassis tuberosa* in less than one meter of water. I brushed some debris off the shell and took a photo. The area where the helmet was found has long smooth sections of old reef bench that run parallel to the shore and is bounded by low ledges and dense short eel grass.

The next day I returned to show the helmet to a few other divers, but the helmet was gone. Having experience with large *Cassis* while living in the Florida Keys, I followed the path of least resistance for a large snail. Sixty meters along the shelf the cleaned helmet was found. The time was approximately 15:00 hours and the helmet was active and approaching a group of long-spine sea urchins; the urchins did not exhibit alarm behavior. Having observed helmets attacking other species of urchins in Florida, I mistakenly assumed the long-spine urchins were not at risk. When the helmet was within a few centimeters of the urchins' spines the helmet raised up on its foot to the height of the spines Figure 1. With short spine urchins, this would allow the snail to arch above the urchin and then drop onto the prey with the foot of the snail securing the urchin. As soon the helmet reached its

ISSN 0738-9388

maximum height, which was not high enough to extend above a long-spine urchin, all of the urchins scattered. Three quickly moved down the smooth reef bench and one moved towards a slight rise with eel grass. The flight response of the urchins starts with the rapid movements of all notable spines followed by rapid movement away from the helmet. Based on subsequent video, the urchins on the smooth reef bench were moving away from the helmet at approximately 1 cm/second. The urchin that tried to move up the incline was captured after a change in the attack pattern of the helmet. Two additional attempts to rise up and drop on the urchin failed. As the helmet's shell came down, the shell hit the long spins of the urchin, which pushed the urchin forward and out of reach Figure 2. On the fourth attempt, the snail did not rise up; rather it extended the body forward and worked its way past some of the spines to grasp the urchin and then raised the urchin slightly so that most of the tube feet were no longer in contact with the substrate Figure 3. Urchin spines were being broken off and a trail of debris was left as the attack continued until the urchin was subdued by pulling it closer to the shell which then raised and fell upon the urchin, trapping it in place Figure 4. The entire process took less than five minutes.

The following day the helmet was within two meters of where it had consumed the urchin, and was surrounded by long-spine urchins that exhibited normal behavior. On my return swim, a half hour later, the urchins were in place but the helmet had moved about one meter and was next to the eel grass. It appeared the movement of the helmet had not trigger the flight-response of the urchins. I examined the remains of the dead urchin from the previous day and realized that urchin debris in the area was probably from other *Cassis* feeding nearby. Some urchin tests had a distinctive hole where the helmet had drilled to feed; others were crushed, perhaps after the fact when the test had been weakened, only a few small spines remained on the tests.

On the fourth afternoon, the helmet was on the move so I stayed to make more observations. The helmet passed by two urchins, which showed no alarm behavior. The path of the helmet was going to take it to the other side of the old reef bench, which was densely lined with eel grass. As it approached the edge, three urchins were in its path and the helmet stopped. I was shooting still photos and at this point moved to put the sun on my back and shoot HD video. Within seconds the helmet raised slightly, and the urchins scattered along the old reef. One urchin attempted to retreat into the eel grass but its long spines prevented any real progress through or over the grass. That animal was captured on the first attempt, when the helmet grasped the urchin, then rose up and pulled the urchin under the shell. Close up photos of the foot shows that when the helmet is raised, small strands of mucus with debris from the substrate are shed. It may be that the response of the urchin occurs when they detect the presence of the mucus at a level that triggers flight behavior.

With regards to capturing long-spine urchins, both successful events were aided by environmental factors that prevented the rapid egress of the urchin, an incline with sparse eel grass and a dense stand of eel grass which the urchin could not negotiate.

REFERENCES

Gerace, D. and W. Lindsay. 1992. *Cassis* in Captivity: An Ongoing Research Project. In Proceedings of the Fourth Symposium on the Natural History of the Bahamas, pp. 59-66. Herdy Eshbaugh Editor.

Moore, D. 1956. Observations of Predation on Echinoderms by three species of Cassididae. Nautilus 69(3):73-76.

Figure 1. Helmet rising up to drop on urchin

Figure 2. As the helmet shell contacts the spines it pushed the urchin forward.

Figure 3. Helmet changes attack mode. Note trail of urchin spines and angle of urchin such that most tube feet are not in contact with the substrate.

Figure 4. Urchin captured

ISSN 0738-9388

Diving the Horseshoe

Paul Kanner
10609 Esther Avenue, Los Angeles, California 90064
pkann@ca.rr.com

I'm a California shell diver, a retired Coast Guard licensed skipper and dive master. For 25 years I worked weekends on a Southern California charter boat taking divers to destinations off the California coast. Working on the charter boat afforded me unique access to many places to pursue my passion for seeking shells. The California coast from Santa Barbara to the Mexican border, all 8 of the Channel Islands, the Coronado Islands off the Mexican border and the outer banks of Cortez and Tanner have all been explored seeking shells.

Shells and marine life have been a consuming passion since my childhood. I've sought shells in many places worldwide. Belize and Eleuthera in the Caribbean, Galapagos Islands, Solomon Islands, Northern Philippines, Australia, New Caledonia, Baja California, Revillagigado Islands, Panama and Tikihau, Rangiroa, Nuka Hiva in French Polynesia. Of all the places I've been fortunate to visit and dive, one place in Southern California remains one of my favorites. That is Horseshoe Kelp.

Horseshoe Kelp is is an area approximately 2 miles south of the Los Angeles Harbor entrance. Contrary to its name, no kelp is visible on the surface. However, low lying bull kelp grows in several areas. The Horseshoe is comprised of several rock reefs spread many meters apart and separated by a sand bottom. Depths range from around 70 feet to well over 100 feet. The reefs consists of tall rock structures with under cuts, small caves and crevasses that provide home to fishes and many forms of marine life including shells. It is hard to put in words how beautiful this area is to dive on a day with clear visibility. Affectionately called the Horseshoe, this area has provided me with some of the best shell collecting in all of Southern California. It is best accessed by a private boat. I don't own my own boat but I'm lucky to have a close friend who owns a 25 foot skiff set up strictly for diving. He is not a shell collector but he's happy to dive the Horseshoe any time conditions warrant. Charter dive boats rarely anchor there because of its proximity to Los Angeles Harbor. Ship and boat traffic that traverse the area is a major concern for divers.

Diving for shells in California is 10% knowledge of habitat and 90% persistence and luck. You may know habitat but finding collectable specimens is still a matter of luck. My preference for diving this area is because of the number of species that may be found on the rock structures and in the gravely sand surrounding the reefs. In spite of its proximity to Los Angeles Harbor it is a surprisingly prolific habitat.

Here is list of mollusk species I've observed or collected on The Horseshoe: *Neobernaya spadicea*, *Haliotis corrugata* (protected), *Haliotis kamchatkana assimilis* (protected), *Tegula regina*, *Pomulax gibberosus*, *Calliostoma annulatum*, *Calliostoma gloriosum*, *Engina strongi*, *Cancellaria cooperi*, *Forerria belcheri*, *Bursa* (*Crosatta*) *californica*, *Kelletia kelletii*, *Mitra idae*, *Maxwellia gemma*, *Maxwellia santarosana*, *Ocenebra foveolata*, *Pteropurpura macroptera*, *Pteropurpura macroptera*

tremperi, *Pteropurpura vokesae*, *Pteropupura trialata* (on the harbor breakwater) *Ceratostoma nuttalli*, *Ceratostoma foliatum*, *Chlamys hastata*, *Euvola diegensis*, and *Crassadoma gigantea.*

As a serious diver/collector I leave most of the shells I observe and only take what I feel are exceptional specimens. That said, diving the Horseshoe Kelp reefs has been very rewarding. Here are images of a few specimens I've kept in my collection from diving the Horseshoe:

Figure 1. *Pteropurpura macroptera tremperi* (left) and *Pteropurpura macroptera* (right)

Figure 2. *Ceratostoma foliatum*

Figure 3. *Calliostoma annulatum*

Figure 4. *Euvola diegensis* and *Cancellaria cooperi*

ISSN 0738-9388

West Coast Shell Show - May 2016

Lisa Dawn Lindahl
lindahldesigns@gmail.com

The San Diego Shell Club recently hosted the first annual West Coast Shell Show. This fabulous free event, located in historic Balboa Park, San Diego, promises to be the Pacific coast's premiere Conchological/Malacological gathering. Featuring dozens of exhibits, visitors young and old were enthralled by the beauty of specimen shells from around the world, as well as two exciting and informative shell related presentations by Dr. Edward Petuch of Florida Atlantic University.

Dealer Table displaying specimen shells

The exhibits showcased some of the most beautiful and sought after specimens; these shells are the gems of our ocean world. There were numerous amazing display cases and the exhibit hall was packed with tables overflowing with fantastic shell displays - which undoubtedly made it hard for the judges to pick winners. Exhibitors came from all over Southern California and from various states around the country to show their shells and compete for trophies. The Shell Show provided visitors the opportunity to meet and talk to the many of the brave souls who dive to collect these gem quality beauties, unleashing a new disease - "shell pox" on the peaceful populace of casual strollers of Balboa Park. With the shell dealers presence many new (and even some of the most experienced) shellers were able to pick up some great deals on shells for their own collections. The San Diego Union Tribune even sent a reporter to cover the event. I can hardly wait until next year to once again put together my own shell exhibits.

Shell Show guests exploring the world of shells

Viewing the dealer tables

Ed Petuch giving a lecture on molluscan biodiversity

There was barely enough room for everyone to sit

ISSN 0738-9388

West Coast Shell Show Tropies & Ribbons

Festivus Award Winner - Leslie Crnkovic

Best of Show - self collected: Roger Clark

Best of Show - any manner: Larry Buck

Judge's Special Merit: David Berschauer

Judge's Special Merit: Rick Negus

Ed Petuch talking with some Club members

Some Club members from Los Angeles

ISSN 0738-9388

Dad, they're just shells!

David Waller
505 N. Willowsprint, Encinitas, California 92024
dwaller@dbwipmg.com

This is the third article in the series on my thoughts regarding what to do with my shell collection when my collecting days are over. In this article, I discuss the option of bestowing my knowledge of shell collecting to my family in the event they decide to sell the collection when I'm gone.

When I refer to myself as a "collector" that includes learning about the items I'm collecting, obtaining specimens, cataloging them, and yes, eventually disposing of them (you can't take them with you!). In essence, it is a process. However, many of us, including myself, don't consider disposing of our collections as part of this process. In fact, most collectors have not even considered or just can't divest themselves of their collections. When this happens we are, in essence, leaving our families with the daunting task of eventually having to sell or donate our collections. I don't particularly want to leave this for my family to take care of, so, what should I do? After some deliberation, the question of, what should I do? became "What can I do?"

Well, if your family is interested in shells you really don't have a problem. They will be please to accept whatever you give to them. However, there are some of us who are lone collectors and bestowing our knowledge of shell collecting to our families would be like asking them to watch grass grow or count sand grains on a beach. As my son might say, "Dad, they're just shells!" With a heavy heart, I realized that this is just the way it is. However, all is not lost, we all have special interests and shell collecting just doesn't happen to be one that my family embraces. So, for individuals like myself, what can we do? Since it is likely that my family will eventually sell my collection, I began considering what would make this process easier for them to accomplish. I have always maintained a listing of my shells and this will be helpful in knowing what shells are in the collection. In addition, I have always labeled the cases containing the shells, and in many cases, retained the original data slips in the shells whenever possible. My list was created as a simple Excel spreadsheet when there were few programs available for cataloging. However, today, there are specialized databases, such as the Shell CollectionManagement Software available on www.shellcollections.com, which provide a number of advanced search capabilities and image storage. The challenge is making sure that it is always updated. Some of the fields that I use include species name, location collected and size as well as reference citations. This information is relatively static, and once it is logged into the database, it usually doesn't change. However, pricing has been a bit of a problem because they vary so significantly over time that any actual value could be meaningless. Rice's Prices is a shell catalog that provides prices, but it hasn't been updated for over a decade. Ebay and shellauction.net sell shells regularly and would be a terrific resource for determining current prices for shells. However, this can be a daunting task for a collection of a few thousands shells. One suggestion would be to label the more valuable shells with an indicator so that your family can readily identify those shells. One idea would be placing a color or numerical indicator on the box or label accompanying these shells. These indicators could give a relative price in 10s, 100s or 1,000s, whatever the case may be. I currently, use both color with a numerical values. So for example, 3 green would indicate a value range of about $30, 2.5 blue would indicate a range of about $250 and 2.3 red would indicate about $2,300.

Although my thoughts of teaching my family about shells seemed to be an excellent idea at the time, it became quickly evident that this was not the answer. So what is the best answer? My last article in this series will let you know what I think might be the perfect solution to the "what to do with one's shells" problem.

Editor's Note: *The Festivus* is accepting articles for future issues. Articles of a scientific nature may be submitted for the peer reviewed portion of our journal. Please refer to our Guidelines for Authors, and/or Guidelines for the Description of New Taxa in *The Festivus*, both available on our website: http://www.sandiegoshellclub.com/festivus/ Articles are subject to a blind peer review process, and submission of an article does not guarantee acceptance or publication. We also accept articles of general interest to malacologists, conchologists and shell collectors for publication in the general interest section of our journal. All articles must be accompanied by either the author's original artwork, or a signed copyright waiver from the copyright holder.

Back Cover: Shells and photos courtesy of Buzz Owen. Top = *Haliotis kamtschatkana kamtschatkana*, Fisk Mill Cove, California, measuring 117.3 mm; Middle = *H. kamtschatkana kamtschatkana* / *H. kamtschatkana assimilis* intergrade (not a hybrid), Cambria, California, measuring 111.2 mm; Bottom = *H. kamtschatkana assimilis*, Point Conception, California, measuring 153.5 mm. Photos used with written permission, all rights reserved. (Cover artistic credit: Rex Stilwill)

THE Festivus

Vol. 48(4) November 2016

Eastern Pacific Pteropurpura

Freshwater mollusks of Bangladesh

New landsnails from Sumatra and Vietnam

Cones, spindles, abalone and more!

Quarterly Publication of the San Diego Shell Club

ISSN 0738-9388

THE FESTIVUS

A publication of the San Diego Shell Club

Volume: 48 November 2016 ISSUE

MEMBERSHIP AND SUBSCRIPTION
Annual dues are payable to the San Diego Shell Club Membership: Domestic/Foreign $20 (receive e-mail copy of *The Festivus*); Domestic $35 (receive *The Festivus* by mail), Foreign/outside the continental United States $55 (receive a copy of *The Festivus* by mail). Single copies of each regular issue are $10.00 plus postage.

Address all correspondence to:
The San Diego Shell Club, Inc.
P.O. Box 230988, Encinitas, CA 92023

REGULAR CLUB MEETINGS
Club meetings are held on the third Thursday or Saturday of the month, except April, September and December, at either 7:30 p.m. in Room 104, Casa del Prado, Balboa Park, San Diego, or at 12:00 noon at Holiday Inn Express, 751 Raintree Dr., Carlsbad, conference room or as noticed.

FACEBOOK
https://www.facebook.com/groups/620724271299410/

WEBSITE
http://www.sandiegoshellclub.com
Submit comments or suggestions regarding our website to our Webmaster David Waller at dwaller@dbwipmg.com.

FRONT COVER:
This image shows a beautiful specimen of *Lyncina broderipi* (Gray in G.B. Sowerby I, 1832) at 42 m on rocky reef off southern KwaZulu Natal South Africa; the photo was taken by Valda Fraser in deep water while diving on January 2, 2010, approximately 60 miles south of Durban. Photo used with written permission, all rights reserved.
(Cover artistic credit: Rex Stilwill)

MISSION STATEMENT
The San Diego Shell Club was founded in 1961 as a non-profit organization for educational and scientific purposes. More particularly to enjoy, study and promote the conservation of Mollusca and associated marine life through lectures, club meetings and field trips. Our membership is diverse and includes beginning collectors, scientists, divers, underwater photographers and dealers.

THE FESTIVUS is the official quarterly publication of the San Diego Shell Club, Inc. and is issued as part of membership dues in February, May, August and November. *The Festivus* publishes articles that are peer reviewed by our volunteer Scientific Peer Review Board, as well as articles of general interest to malacologists, conchologists, and shell collectors of every level. Members of the Peer Review Board are selected to review individual articles based upon their chosen field of expertise and preference. Available by request or on our website are:

- Guidelines for Authors
- Guidelines for the Description of New Taxa

Submit articles to Editor, David Berschauer, at shellcollection@hotmail.com

All correspondence pertaining to articles, including all submissions and artwork should be addressed to the Editorial Board.

ADVERTISING in *The Festivus* is presented as a service to our membership and to supplement publication costs. Advertising does not imply endorsement by the San Diego Shell Club, Inc. or its officers. Advertising space is available at the following rates: Black and White – ½ page $300, ¼ page $150, or ⅛ page $75, Color – ½ page $500, ¼ page $205, or ⅛ page $125. Deadline for submitting advertisements is the 15th of the month prior to publication. Submit advertisements to our Advertising Director, at: dwaller@dbwipmg.com

UPCOMING CLUB EVENTS:
November Auction: 11/19/16
December Party: 12/10/16

Mark your calendars now our second annual West Coast Shell Show: August 25-27, 2017

Publication date: November 4, 2016

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 4

TABLE OF CONTENTS

New Taxa published in The Festivus in 2016: Volumes 48(1) through 48(4)

Species and subspecies:
Oliva hirasei ameliae Strano, 2016, *Haliotis arabiensis* Owen, Regter & Van Laethem, 2016, *Lautoconus saharicus* Petuch & Berschauer, 2016, *Harpa queenslandica* Berschauer & Petuch, 2016, *Camaena abbasi* Thach, 2016, *Amphidromus stevenliei* Parsons, 2016, *Marginella spadix* Veldsman, 2016, *Viduoliva tricolor abbasai* Thach & Berschauer, 2016, *Jaspidiconus boriqua* Petuch & Berschauer, 2016, *J. culebranus* Petuch & Berschauer, 2016, *J. janapatriceae* Petuch & Berschauer, 2016, *J. marcusi* Petuch & Berschauer, 2016, *J. masinoi* Petuch & Berschauer, 2016, *Miliariconus sinaiensis* Petuch & Berschauer, 2016, *Amphidromus bulowi malalakensis* Parsons & Abbas, 2016, *Vasticardium swanae* Maxwell, Congdon & Rymer, 2016, *Camaena chuongi* Thach, 2016, *Lamniconus petestimpsoni* Petuch and Berschauer, 2016, *Poremskiconus fonsecai* Petuch and Berschauer, 2016, *P. smoesi* Petuch and Berschauer, 2016, *Jaspidiconus josei* Petuch and Berschauer, 2016, *Fusinus damasoi* Petuch and Berschauer, 2016, *F. mariaodeteae* Petuch and Berschauer, 2016.

ISSN 0738-9388

Native *Pteropurpura* of the Eastern Pacific (Muricidae)

Paul Tuskes and Ann Tuskes
3808 Sioux Ave, San Diego, California 92117
tuskes@aol.com

ABSTRACT Eight species in the genus *Pteropurpura* are known to occur in the Eastern Pacific, from central California to Peru. All eight species are found in the California or Panamic marine provinces. *Pteropurpura deroyana* occurs only in the southern portion of the Panamic province off the Galapagos Islands. New biological, distribution, depth, substrate, and shell length information is presented. The generic status of two species *P. leeana* and *P. festiva* are in flux, and until genetic analysis suggests otherwise they are assumed to belong to this genus.

KEY WORDS *Pteropurpura*, Muricidae, Gastropoda, Panamic Marine Province, California Marine Province.

INTRODUCTION

On a worldwide basis there are approximately 27 species in the genus *Pteropurpura.* Currently, eight native Muricidae of the genus *Pteropurpura* occur in the Eastern Pacific; *P. centrifuga* (Hinds, 1844), *P. deroyana* Berry (1968), *P. erinaceoides* (Valenciennes, 1832), *P. festiva* (Hinds, 1844), *P. leeana* (Dall, 1890), *P. macroptera* (Deshayes, 1838), *P. trialata* (Sowerby, 1841), and *P. vokesae* (Emerson, 1964). With the exception of *P. deroyana,* which is restricted to the Galapagos Islands of Ecuador, the other seven species are shared between the temperate to subtropical California marine province and the tropical Panamic marine province.

The California marine province extends from Point Conception, Santa Barbara County, southern California, past Cedros Island, Baja California to Asuncion Bay, Baja California Sur, Mexico. Seven species overlap in the southern portion of the California province and in the poorly defined transition zone between the California and Panamic marine provinces from Asuncion Bay to Magdalena Bay, Baja Sur. A review of mollusk groups such as cones, cowries, murex and cassia indicates a prevalence of tropical Panamic species at Magdalena Bay that are, for the most part, absent from the area of San Ignacio Lagoon and Asuncion Bay to the north (Keen, 1971). At Asuncion Bay many of the gastropods are typical of those found in San Diego, California. The Panamic province includes the southern tip of Baja California Sur on the Pacific side, and from the Gulf of California south to Ecuador/Peru. *Pteropurpura* are not known from the South American marine province.

The goals of this paper are to discuss the native Eastern Pacific *Pteropurpura*, provide new information regarding their biology and distribution, consolidate information, and to briefly discuss the status of *P. festivus* and *P. leeana. Pteropurpura falcata* (Sowerby II, 1834) (syn *P. aduncus* Sowerby II, 1834) a non-native species introduced to central California is not within the scope of this paper. This species is in a California Marine Protection Area and therefore presents regulatory and permitting issues that we have not pursued.

ISSN 0738-9388

Materials/Methods

Museum material examined included: Natural History Museum of Los Angeles County (NHMLAC), Santa Barbara Museum of Natural History (SBMNH), San Diego Natural History Museum (SDNHM), Scripps Institution of Oceanography (SIO) and the Benthic Invertebrate Collection, California Academy of Science data base. Depth, substrate and specific locality data from museums, collectors, divers, and research vessels are quite valuable and summarized here in general terms. In addition, we have observed all of the species that typically occur at depths of less than 30 meters. Data based on material from shrimp boats is not included as they travel extensively in the Gulf, so most of those shells are labeled with the location they were purchased.

Abbreviations
Baja = Baja California, Mexico
Baja Sur = Baja California South, Mexico
CA = California, USA
m = meter
mm = millimeter

DISCUSSION

***Pteropurpura* History in the Eastern Pacific Species.** *Pteropurpura* is placed in the Subfamily Ocenebrine based primarily on characteristics of their radula, a fused siphon canal, and structure of the operculum. The genus contains four subgenera (*Pteropurpura*) Jousseaume (1880), (*Poropteron*) Jousseaume (1880), (*Ocinebrellus*) Jousseaume (1880) and (*Calictrapessa*) Berry (1959) to account for diverse morphologies. Future molecular work will be critical in defining the genus, once that data is integrated with morphological and biogeographical studies.

Past taxonomic confusion within the Eastern Pacific *Pteropurpura* is understandable. When described, *Murex macropterus* (Deshayes, 1838) was not illustrated, and no locality data was provided. That species would eventually become the type for the genus *Pteropurpura.* Dall began naming new species of three winged murex from California [*M. rhyssus* Dall, 1919 and *Pteronotus carpenteri* Dall 1899 (= *M. petri* Dall, 1902)] but issues with the descriptions raised concerns. The work of Dall was used by subsequent west coast authors (Keep, 1904, Oldroyd, 1927) but was not accepted universally. Abbott (1954) treated *Pteropurpura* as a section under the subgenus *Pterynotus* Swainson (1833), he considered *M. carpenteri* to be a subspecies of *M. trialatus,* and listed *M. rhyssus* as a subspecies of *M. erinaceoides.*

Between the works of Abbott (1954 & 1974), Emerson (1964a) located the type specimen of *M. macropterus* and provided the first illustration. He recognized *Pteropurpura* as a distinct genus and treated *M. carpenteri* and *M. petri* of Dall as junior synonymies of *P. macroptera.* Next, Emerson (1964b) realized that *M. rhyssus* was a homonym and offered the replacement name *P. vokesae,* treating it as a distinct species and pointing out how it differed from *P. erinaceoides.* Abbott (1974) later accepted the generic status of *Pteropurpura* but doubted the species status of some California material.

The *Murex Shells of the World* by Radwin & D'Attilio (1976) includes a good review of morphological information and species composition of *Pteropurpura.* It is interesting to note that they retained both *P. festiva* and *P. leeana* in *Pteropurpura,* refuting the past positions of *P. festiva* in *Jaton* Pusch (1837) and *Shaskyus* Bureh & Campbell (1963) and that of *P. leeana* in *Calcitrapessa* Berry (1959). In addition, they raised the subgenus *Poropteron* to generic status, and both *M. erinaceoides* and

M. vokesae were placed in the genus *Ocenebra* Gray (1847).

Later D'Attilio and Myers (1983), focused only on *Pteropurpura* and listed the known species. Without explanation they returned *O. erinaceoides* and *O. vokesae* to *Pteropurpura* and returned *P. festiva* to *Shaskyus* and *P. leeana* to *Calcitrapessa;* the removal of these two species was not widely accepted.

Prior to 1960 most of these shells were not common in institutional collections, as a vessel was needed to collect deeper water species. After the wide spread use of SCUBA gear, divers made many rare species common place and readily available in museum collections.

Two problem species. A review of the species illustrated (Figures 1-15) indicate how divergent *P. festiva* and *P. leeana* are from each other and other members of the genus. Mature *Pteropurpura* have three large varices (trivaricate) that extend outward from the current and previous distal aperture of the lip. The margins of the varices may be simple (*P. festiva*), scalloped (*P. macroptera, P. trialata*), have extended spurs on the margin that form distinctive recurved hook-like structures (*P. centrifuga, P. erinaceoides, P. vokesae*), or have a single long heavy spine on each varices (*P. leeana*).

Pteropurpura festiva appears to have shorter varices, with a simple margin that uniformly recurves as much as 180 degrees along its entire length (Figure 7). Tuskes & Tuskes (2009) pointed out that this species can be found in surf-prone rocky coast feeding in the intertidal and subtidal zone. The curvature of the large varices effectively shortens their height and may be an adaptation to streamline the shell, thereby reducing the force of waves striking the shell. It may also allow an animal that becomes dislodged to right itself more quickly. The apparent height of the varices for *P. festiva* (ca 60 mm in length) is 4 to 5 mm but when the width is measured, over the 180 degree arc, it is 11 to 13.5 mm. The scalloped varices of similar sized *P. macroptera* varied from 9 to 15mm in height. As such, the varices of *P. festiva* are similar in width to *P. macroptera* but because they are folded, they are approximately one half to one-third the height. Unless genetic data proves otherwise, we believe that *P. festiva* is properly placed in *Pteropurpura.*

Within *Pteropurpura*, the shape of large varices found on *P. leeana* (Figures 8-9) are unique. The apex of the varices is nearly at a right angle to the columella of the shell. The spine is formed as the margins roll ventrally to produce a channel while the remainder of the varice tapers to the anterior end of the shell forming the closed siphon canal with no additional spines, and no apparent transition to form the siphon canal. All other species in the Eastern Pacific have a sharp distinctive transition from the varices to the siphon. Upon close inspection of *P. leeana*, it seems likely that if an animal were to be tipped to the side, it would be difficult for it to gain sufficient leverage to right itself. Since *P. leeana* is a deeper water species, and not likely to be significantly impacted by ocean swells, tipping over may be a low probability event. Holding specimens in your hand and noting the difference in shape, orientation, and strength of the spines suggest they may be a defense against large rays which typically crush a shell to feed on the animal within. When tissue is available for DNA analysis, we may have a more definitive answer as to its generic status.

Species Account

1. ***Pteropurpura centrifuga*** (Figures 1-2) is the second largest species in the region. Specimens 50 mm and greater typically express adult shell

characteristics. The final varices of all mature shells have 3 to 4 extended spines that are pinched together forming a distinctive dorsal ridge and the apical spine typically recurved by up to 90 degrees. The largest spine is at the apex with shorter spines midway to the anterior siphon. It is not unusual for the large apical spine of the varices to be broken. The shell may be white or white with distinctive yellow-brown bands Figure 1. When banding is present it is displayed on both sides of the varices.

A small cross section of records for depth and substrate in Mexico includes: Gulf of California, (Sonora) Guaymas 64-91 m, San Carlos 100 m, Doble Point also near San Carlos 95-115 m on coarse sand and dead shell; (Baja) San Juanico Bay 64-91 m in cobble, Los Angeles Bay 219-310 m; (Baja Sur Gulf) Conception Bay 46 m, Danzante Island 120 m, La Paz 45-55 m, Espirita Santos Island 164 m; (Baja Sur West Coast) Magdalena Bay 77-80 m; and (Baja West Coast) Cedros Island 76 m. Museum records indicate divers have found them on occasion in the range of 30-40 m, on sandy-mud bottoms with notable shell debris. The depth and substrate explains why specimens are taken by shrimpers. It is likely that the prey species are either bivalves or marine worms.

Range: Uncommon or absent from the northern Gulf of California. The occurrence of this species is well documented from the area of Los Angeles Bay and Guaymas in the Gulf of California south to Playa Gauyas Provence, Ecuador. Recently, Bertsch and Rosa (2016) cited a record from Caleta La Cruz, Peru. On the Pacific coast of Baja they have been collected as far north as Cedros Island.

Length: Most shells measure 60–75 mm in length, large specimens range from 80 to 90+ mm.

2. *Pteropurpura deroyana* (Figures 3-4) is endemic to the Galapagos Islands, Ecuador. When compared to *P. centrifuga* the shell of *P. deroyana* is easily distinguished as the apical spines on the varices are typically more flattened, extend upward, and are only slightly recurved; the surface of the shell is lightly but distinctly textured whereas *P. centrifuga* is smooth, larger and more robust with recurved spines on the varices. The shell of *Pteropurpura deroyana* is smaller, fragile and narrower than that of *P. centrifuga*. The species is uncommon in collections; Keen 1971 illustrated the ventral surface of a 33 mm specimen taken at 100 m. We examine two specimens collected in 1969 at a depth of 179 m off the south coast of Santa Cruz Island, in the Galapagos. Both shells are illustrated, the largest measures 58 mm the other, which had been cleaned is 43.7 mm, and are in the collection of Don Pisor. The texture of the shell surface is apparent as debris in the shallow grooves helps with the contrast on the larger individual.

Range: Restricted to the Galapagos Islands of Ecuador.

Length: 33-58 mm.

3. *Pteropurpura erinaceoides* (Figures 5-6) has mature varices with an apical spine that narrows and recurves, while the rest of the varices have five to seven short recurved spines, with a shape and size similar to those of *P. vokesae*. Shells may be white or light brown; some have contrasting banding that is dark to light brown or off-white bands present on the shell and both sides of the varices. With the exceptions of the larger apical spine, most spines measure 4 to 7 mm. Mature and juvenile animals are often found in the same environment and can be locally common. They occur both intertidal and subtidally and are found on rocks, under rocks, and occasionally attached to the base of rocks

just below the level of sand/silt. Eggs are deposited on rocks in the spring, sometimes in mass by many females. There is no parental care once the eggs are deposited.

The majority of the records are from intertidal collections, but specimens are also taken by divers and dredging. There does not appear to be a relationship between the depth and size of the shell. Specimens over 55 mm are not common. The largest intertidal shells in museum collections were 58.5 mm from Los Angeles Bay, Baja, and 61 mm from Requeson in Conception Bay, Baja Sur. Most specimens collected by divers are from less than 20 m but dredged specimens have been taken to at least 57 m. A series of 35 shells from San Luis Gonzaga, Baja, ranged from 14 to 35 mm in length, with a median size of 31 mm.

Range: Records extend from Puerto Penasco in the northern Gulf of California, south to Cabo San Lucas and north on the Pacific coast of Baja Sur to San Ignacio lagoon where they were found intertidally (ISO) and to the area of Guerreo Negro. The species is ubiquitous on the east side of the Gulf and has been found to the south in the states of Nayarit (Banderas Bay) and Oaxaca (Salina Cruz) Mexico.

Length: 25-40 mm is typical, large specimens exceed 55 mm. The largest shell measured was 64.3 mm in the collection of Larry Catarius.

4. ***Pteropurpura festiva*** (Figure 7) is found from the intertidal zone to approximately 25 meters; below that depth they are not commonly encountered. Fotheringham 1971 published a paper on a population of *P. festiva* found on the exposed rocky coast just north of San Diego, California, which provided a comparison for our later work in varied habitats. Immature and small adults are commonly found in the rocky intertidal zone. On the exposed rocky coast only 25-35% of the animals measured were greater than 30 mm in length, and no shells in a sample of 661 live animals exceeded 45 mm. While in protected areas of Quivira Basin, (Mission Bay, San Diego, California) greater than 95% of the 160 animals measured were between 31 and 55 mm.

Individuals in the intertidal zone feed primarily on barnacles during high tide and may move lower as the tide retreats, where they feed on limpets, especially the file limpet *Collisella limatula* (Carpenter, 1864). Larger adults are more often found in protected waters or in deeper water. In Mission Bay, large individuals are found on sand and measure 55 to 60+ mm. Large animals feed primarily on bivalves especially *Chione* and *Protothaca* and the attack pattern varies by prey species (Tuskes and Tuskes 2009). Adults have also been documented many times feeding with *Conus californicus* Reeve, 1844 on live bubble snails *Bulla gouldiana* Pilsbry, 1893 (Tuskes 2011). Adults breeding on the exposed rocky coast and jetty entries are smaller than breeding populations in bays. The difference in size may not be age related, but rather availability of food sources. In Mission Bay, reproduction occurs year-round, with a peak between May and August. Female *P. festiva* often lay their eggs in mass on rocks and other hard substrate. The biology of this species (prey selection, reproduction, habitat preference, *etc.*) was published by Tuskes and Tuskes 2009.

Range: Point Conception, Santa Barbara County, California south to Asuncion Bay in Baja Sur. The most southern record is from Magdalena Bay, Baja Sur. North of Point Conception, the species is infrequently found, with a record from Morro Bay and recently two specimens were documented from Monterey, California (Clark, 2016).

Length: 25 to 55mm, few shells exceed 60 mm. The largest specimen measured 67.4 mm, and collected from San Pedro Harbor, Los Angeles, California, Negus (1991).

5. ***Pteropurpura leeana*** (Figures 8-9) is a distinctive species and infrequently collected. They are collected by dredging, tangle nets, and occasionally by shrimpers. Battered specimens, which have lost most of their distinctive spines occasionally wash ashore. The shells of *P. leeana* are the most divergent within the genus, as the varices are modified to form large spines that surround the shell. The varices taper sharply from the spine to the body of the shell to form the closed siphon canal without the distinctive transition seen in the other species. This adaption makes the siphon much stronger and reminiscent of an additional spine. The consecutive varices of *P. leeana* do not line up; rather they are offset by 20-30 degrees distributing the spines in a greater arc. Shells with their spines intact can be as wide as the shell is long.

Range: This species is infrequently taken in the Gulf of California. Most specimens are from the Pacific side of Baja and Baja Sur primarily from Cedros Island south to Magdalena Bay. Beach worn specimens have been found further north. The most northern record is a 54 mm specimen taken NW off Anacapa Light, Anacapa Island, southern California at 86-96 m, 16 March 1941 R/V Velero (Figure 9) in the collection at NHMLAC.

Length: Mature shells measure 50 to 60 mm; shells 60 mm and greater are notably sturdier than smaller shells. The largest shell measured was 81.5 mm and in the collection of John LaGrange.

6. ***Pteropurpura macroptera*** (Figures 10-12). The base color of the shell varies from purple-brown , light brown, to nearly white. The color form *tremperi* (Figure 12) has white streaks across the shell and varices and are infrequently collected. The texture of the shell varies from nearly smooth to vary scaly and the margin of the varices may be deeply or moderately scalloped, or have little scalloping.

Most live specimens are less than 45 mm in length, but divers often pick up larger individuals. As a result both museum and private collections tend to have specimens 50 mm or greater. A high percentage of specimens from central California are said to have smoother margins on the varices than those from southern California, but we have not observed that based on museum material.

Bob Abel (personal communication) has taken *P. macroptera* in Fish Mill Cove, Sonoma County and noted that smaller individuals could be found at 11 m with larger specimens found deeper. In southern California, this species is taken by divers as shallow as 16 m, but more often at 20 m or greater on hard surfaces. A live 50 mm specimen was collected while dredging a rocky portion of the 9 Mile Bank, San Diego, California, at 155 m by J. LaGrange in1992, and at a depth of 100 m off Cedros Island, Baja Ca. In Baja Sur, they have been dredged at 37 m south of Point Eugenia and 99 m off Point Abreojos (NHMLAC).

Three specimens have been collected in the Gulf of California. Skoglund (1983) illustrated a live 38 mm specimen collected while dredging at a depth of 182 m off Los Angeles Bay, Baja. That specimen was deposited in the SBMNH and we have examined the shell. We found a 55 mm *P. macroptera* mixed in with a batch of *P. erinaceoides* from San Luis Gonzaga. Baja, at station #4 February 1967 by E. Hailey, the data slip did not record depth information (SBMNH). A third specimen was acquired from shrimpers

at Loreto but the exact collection site is unknown.

Range: The species is known from Fish Mill Cove Sonoma County California south to Point Abreojos in Baja Sur. Two confirmed specimens from the upper Gulf of California may represent a relictual population.

Length: In Southern California, most specimens in collections are 50 to 55 mm, large individuals exceed 60 mm. The largest shells measured were from Santa Barbara County, California and measured 72.4 and 72.8 mm (SBMNH).

7. *Pteropurpura trialata* (Figures 13-14). Surprisingly, unlike many other *Pteropurpura* from the region, the immature stages of this species appears to be unknown. The smallest shell examined was a 29 mm sub-adult. The shell is white to off-white, with light to dark brown banding that may coalesce or remain separate. Unlike other eastern Pacific *Pteropurpura*, the banding on the shell is not expressed on the inner varices. In Mission Bay, perhaps 5% of the shells are alba. In Southern California, variation in the extent of scalloping on the margins of the varices, varices orientation, and shell length to width ratio are notably different between San Diego and Los Angeles. For more detailed information *see* Tuskes and Tuskes (2015).

Adults and sub-adults feed on the vermetid gastropod *Thylacodes* (formally *Serpulorbis*) *squamigerus* (Carpenter, 1857) which is a filter feeder found most commonly where there are notable currents. Tuskes and Tuskes (2015) published on the life history of this species. Growth occurs commonly when the water temperatures are cooler, from December through February, and tapers off with warmer water after April. Most mature animals add one varices per year until fully grown. Sub-adults may produce multiple varices per year. Based on (1) the extent of erosion on the apex, (2) the inability to replace damaged syphons, and (3) accumulation of fowling organisms; we estimate that females live to breed two additional years after growth has halted. Reproduction peaks in April and May as the water warms. Clusters of egg capsules are usually deposited on nearly vertical rock surfaces with minimal growth of red and brown algae present. Unlike *P. festiva* and *P. erinaceoides,* female *P. trialata* do not usually gather to lay egg capsules in mass. The average number of egg capsules per cluster is 60, and each capsule contained an average of 484 embryos, which emerge as veligers in 19-21 days at 70°F.

Predation on adult animals has not been directly observed, but when empty shells of the species were glued to rocks and placed in the habitat near the rock-sand interface to estimate fouling rates, the vast majority of the shells were crushed and removed, probably by bat rays. We have observed and photographed bat rays feeding on other large shelled gastropods in Southern California.

Range: Point Conception Santa Barbara County, California south along rock coast and islands to similar habitat in Baja California Sur, Mexico, In Baja Sur, the species has been collected intertidally at Guerreo Negro and Point Asuncion, and Point San Pablo at 21-30 m. It would not be surprising if they occur farther south in suitable rocky habitat. Tuskes & Tuskes (2015) found that publications indicating this species occurs in Northern California are in error and based on miss-identification of *Ceratstoma foliatum* (Gmelin 1791) as *P. trialata.*

Length: 45 to 70 mm. Large shells exceed 80 mm. The largest specimen we measured was 105 mm in the SBMNH collection; very few shells exceed 90 mm. To understand the size distribution of a natural population, we dove Mission Bay, San Diego, California with a goal to measure the first 150 specimen observed regardless of size. A total of 158 specimens were measured and then released back into their environment. The size ranged from 44.1 to 74.7 mm with a mean of 63.3 mm and average of 62.4 mm.

8. *Pteropurpura vokesae* (Figure 15). Although *P. vokesae* can be taken on the same dive with *P. macroptera* they are most prevalent in sand and small rubble adjacent to rocky reef which is the preferred habitat of *P. macroptera*. Shells in small rubble at a depth 30 m off Point Loma, San Diego, are heavily encrusted, whereas, in areas where they spend time buried in sand, they are nearly free of fouling organisms. Larry Catarius (personal communication) found them buried in sand during the day with only the sponge covered dorsal varices partly exposed. Catarius noted that during dense red tide above the thermocline, dive lights were needed during the day in the clear water below. During those dives far more *P. vokesae* were found on the surface of the sand, suggesting they may be an active nocturnal predator.

Although this species has been found as shallow as 8 m in Mission Bay, that is an exception. Most specimens are taken by divers at 20-30 m and it has been dredged in Baja Sur at 99 m. It's likely that in the sand habitat the species feeds on bivalves or marine worms. It is surprising that there are no published records as to their prey species, considering the number of *P. vokesae* and *P. macroptera* that have been collected/observed. *Pteropurpura vokesae* exhibits little variation in color, other than intensity, and does not have white radial bands as do some of its close relatives, such as *P. erinaceoides*.

Range: Point Conception, southern California, south through Baja, with the southern records off Point Abreojos at 32-38 m in Baja Sur.

Length: Individuals from 35 to 45 mm are typical. Those in the range of 55 to 65 mm are less common. The largest specimen we measured was 71 mm.

ACKNOWLEDGEMENTS

We thank Lindsey Groves of the Los Angeles County Museum of Natural History, Hank Chaney and Daniel Gieger of the Santa Barbara Museum of Natural History, Michael Wall of the San Diego Museum of Natural History, and Harim Cha of the Scripps Institute of Oceanography, Benthic Invertebrate Collection, for allowing us access to their collections. We also thank Margret Dyken, the San Diego Museum of Natural History Museum, Library Manager for assistance with literature, as well as Larry Catarius, Don Pisor, John LaGrange, and Bob Abela for sharing information and allowing access to their collections.

REFERENCES

Abbott, R.T. 1954. American Seashells. Pub. D Van Nostrand Co. Inc., Toronto, Canada. pp 205-206.

Abbott, R.T. 1974. American Seashells. Pub. D Van Nostrand Co., Inc, Toronto, Canada. pp 176-177.

Bertsch, H. and L.E. Aguilar Rosa. 2016. Marine Invertebrates of Northwest Mexico. Pub, Instituto de Investigaciones Oceanologicas , UABC Ebsebada xxxii + 432 pp.

Clark, R.N. 2016. *Pteropurpura festiva* (Hinds, 1844) in Monterey Bay. The Festivus 48(1):32.

D'Attilio, A. & B. Myers. 1983. The genus *Pteropurpura* Jousseaume, 1880 (Muricidae: Ocenebrinae). The Festivus XV(11):111-112.

Emmerson, W.K. 1964a. On the identity of *Murex macropterus* Deshayes, 1839 (Mollusca: Gastropods). The Veliger 6(3): 151-155.

Emmerson, W.K. 1964b. A New Name for *Murex rhyssus* Dall, 1919 (Mollusca: Gastropods). The Veliger 7(1):5-6.

Fotheringham, N. 1971. Life history patterns of littoral gastropods *Shaskyus festivus* (Hinds) and *Ocenebra poulsoni* Carpenter (Prosobranchia: Muricidae). Ecology 52(5): 743-757.

Keep, J. 1904. West American Shells. Pub. The Whitaker & Ray Company, San Francisco. 360 pp.

Keen, A.M. 1971. Sea Shells of Tropical West America. Stanford University Press, Stanford, CA. 1064 pp.

Negus, R. 1991. *Pteropurpura festiva* (Hinds, 1844). The Festivus. 23(4):29.

Oldroyd, I. 1927. The Marine Shells of the West Coast of North America, Stanford University Press, Stanford University Press, Stanford, CA. Vol 2, part 2 pp. 307-311.

Radwin, G.E. & A. D'Attilio. 1976. Murex Shells of the World. An Illustrated Guide to the Muricidae. Stanford University Press, Stanford, CA. p 119-133.

Skoglund, C. 1983. Range Extensions of Muricidae in the Gulf of California, Mexico, the Festivus 15 (11):107-108.

Tuskes, P. 2011. Observations on the Biology of the Bubble Snail, *Bulla gouldiana* in Mission Bay, San Diego, California. The Festivus 43(7):69-75.

Tuskes, P. & A. Tuskes. 2009. Influence of Habitat on Growth and Prey Selection of *Pteropurpura festiva* the Festive Murex. The Festivus 41(3) 25-29.

Tuskes, P. & A. Tuskes. 2015. Observations regarding the Biology of *Pteropurpura trialata*. The Festivus. 47(2):85-94.

OTHER USEFUL REFERENCES

McLean, J.H. 1978. Marine Shells of Southern California. Science Series 24, Zoology No. 11. Los Angeles County Museum of Natural History. 104 pp.

Morris, H.R., D.P. Abbott & E.C. Haderlie. 1990. Intertidal Invertebrates of California. Stanford University Press, Stanford, CA. Chapter 13 Prosobranchia: Marine Snails, pp. 230-307.

ISSN 0738-9388

Pteropurpura* of the Eastern Pacific. Figures 1 to 15.** ***P. centrifuga Guaymas area, Sonora, Mex. **(1)** 76 mm and **(2)** 83 mm. ***P. deroyana*** Isla Santa Cruz, Galapagos Islands, Ecuador **(3)** Dorsal & ventral surface 58 mm and **(4)** 43.7 mm. ***P. erinaceoides*** Puertocitos, Baja Ca. Mex. **(5)** Dorsal & ventral surface 47 mm and **(6)** Isla Danzante, Baja Sur, Mex. 54 mm. ***P. festiva*** **(7)** Dorsal & ventral surface, Mission Bay, San Diego CA. 57 mm. ***P. leeana*** **(8)** Off Cabo San Lucas Baja Sur, Mex. 57 mm and **(9)** Ana Capa Island, Santa Barbara Co. CA. 54 mm. ***P. macroptera*** **(10)** Dorsal & ventral surface, Santa Barbara, CA. 54 mm, **(11)** white form, San Diego, CA. 42.9 mm and **(12)** form *tremperi*, San Diego, CA. 62 mm. ***P. trialata*** **(13)** Ventral **(14)** Dorsal, both San Pedro Breakwater, Los Angeles, CA. 86 mm. ***P. vokesae*** **(15)** Dorsal & ventral surface, Santa Barbara, CA. 53 mm.

ISSN 0738-9388

Checklist of Freshwater Mollusca (Gastropoda and Bivalvia) Recorded from the Buriganga and Turag Rivers, Dhaka, Bangladesh

Mohammad Abdul Baki, Md. Muzammel Hossain* and Naser Ahmed Bhouiyan
Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh
*Corresponding author's email: muzammel3@gmail.com

ABSTRACT Freshwater mollusks have received little attention from conservation scientists. We collected museum records and conducted an inventory of freshwater mollusks to develop a species checklist for the Buriganga and Turag Rivers. The study area extended from the Posthoghola Bridge (90°26′12" E and 23°40′25"N), Buriganga River to the Tangi Bridge, Turag River (90°24′29"E and 23°53′59"N). Surveys were conducted every two weeks from December 2012 to November 2013 in both rivers. During the survey period we collected mollusks by hand picking. A total of 17 species belonging to 8 families (Ariophantidae, Viviparidae, Pilidae, Thiaridae, Lymnaeidae, Unionidae, Cyrenidae and Solecurtidae) were identified from both rivers. Among the 17 species, 14 were identified in the Buriganga River and 12 species were found in the Turag River. *Corbicula fluminea* (O. F. Müller, 1774), *Lymnaea luteola* (Lamarck 1822) and *Macrochlamys sequax* (Benson, 1859) were found in the Buriganga River and *Bellamya dissimilis* (Müller, 1774), *Paludomus conica* (Gray, 1834) and *Novaculina gangetica* (Benson, 1853) were found in the Turag River. Muddy, sandy and stony benthic and littoral habitats were observed in both rivers. It is our hope that this study will stimulate additional mollusk research in this area.

KEY WORDS Freshwater Mollusca, Buriganga and Turag Rivers.

INTRODUCTION

Freshwater mollusks (Gastropod: Snails; Mussels: Bivalvia and Unionoida) are an important component of many healthy river ecosystems. In addition, freshwater mollusks often are used by various agencies to monitor environmental quality, including trends of chemical contamination (Rosenberg and Resh 1993; Supian & Ikhwanuddin, 2002). Mollusks are one of the most threatened major taxonomic groups worldwide, comprising 42% of all species extinctions (Lydeard *et al.*, 2004). Within this group, the freshwater mussels of the order Unionoida are highly threatened throughout their distribution (Bogan 1993). Today, the numbers of threatened species and species extinctions have increased at an alarming rate (Baillie *et al.*, 2004; Lydeard *et al.*, 2004). Humans, directly or indirectly, are largely responsible for these species losses (Wilson 1989). Freshwater mollusks have been affected by both extrinsic factors such as habitat destruction, land-use practices, water pollution, reduction or loss of host plant and/or organisms like fish or substrates, and intrinsic characters such as growth and reproduction, which evolve in close relation with habitats (Stearns 1992; Petts *et al.*, 1993; Richter *et al.*, 1997; Primack 2002). One interesting intrinsic character is that of life span. Long-lived species generally grow slowly and have delayed maturity and low fecundity. Thus, long-lived species may tolerate short-term fluctuations in the environment, but if population numbers are severely reduced,

recovery may be slow, increasing the risk of extinction (Drechsler *et al.*,1999; Bauer 2001; Raimondo & Donaldson 2003; Wheeler *et al.*, 2003). Furthermore, the life cycle of all freshwater mussels includes a period during which mussels are dependent on a fish host (Nedeau *et al.*, 2009). Furthermore, mussels provide food for fish, birds, and mammals.

Thirteen species of freshwater bivalves (twelve native, one introduced) have been reported historically in the mainstream Columbia River (Frest and Johannes 1993). Stark (2001) found only rare occurrences of mussels during a study of macro-invertebrates on the Hanford Reach at three locations near several miles from the river. Twenty land, 22 freshwater and 437 marine and brackish water mollusks species belonging to 210 genera, 105 families and 23 orders under 4 classes have been recorded in Bangladesh (Siddiqui *et al.*, 2007). In September 2009, four rivers around the city of Dhaka city, the Buriganga, the Sitalakhaya, the Turag and the Balu, were declared as Ecologically Critical Areas (ECAs) by the Department of Environment, Bangladesh as part of the plan to protect the rivers from encroachment as well as for the conservation of their biodiversity. Current knowledge of freshwater mollusk populations in the Buriganga and the Turag Rivers is limited. Data describing fresh water mollusk species composition and other attributes are needed to aid in assessments of environmental quality of this river ecosystem. The objective of this study was to establish an inventory of mollusk taxa in the Buriganga and Turag Rivers and their tributaries to provide a more comprehensive characterization of the freshwater mollusk species composition in the study area.

MATERIALS AND METHODS

Study area: The study area extends from the Bangladesh - China Motri bridge, Buriganga river (90°26′12" E and 23°40′25"N) to the Tangi Bridge, Turag River (90°24′29"E and 23°53′59"N). Two surveys were conducted per month from December 2012 to November 2013.

Buriganga River: The Buriganga River is one of the most polluted rivers in the city of Dhaka. Half of the slope of the rivers within the study area is covered by concrete block and the remainder is dust, mud and sand habitat. It is also one of the most polluted rivers in Bangladesh.

Turag River: The Turag River is the upper tributary of the Buriganga River, a major river in Bangladesh. The river originates from the Bangshi River. The latter is an important tributary of the Dhaleshwari River which flows through Gazipur and joins the Buriganga at Mirpur. The Tongi khal links the Turag with the Balu River. The River bank covered by dust, mud, sand and vegetation habitat.

Survey Technique: Walking along the river banks and boat based surveys were conducted to locate and identify the freshwater mollusca. Specimens were collected by hand from the dry areas and scoop net were used in shallow waters. All samples were collected and transported to the fisheries laboratory, Department of Zoology, Jagannath University, Dhaka. Specimens were preserved in 95% ethanol for identification.

Identification: Species were identified based upon morphological characteristics of the shell and the taxa recognized by Frest and Johannes 1993, 1999; Amit and Roy 2008; Wayne 2003; Norman 1998 and Siddiqui *et al.*, 2007.

Riverbed Characterization: The river bed was classified into three categories: i. Muddy, ii. Sandy, and iii. Stony. Stony and sandy habitat can be found from Bangladesh to China Motri Bridge to Babu Bazar Bridge. Stony, sandy and muddy habitat can be found from Babu Bazar Bridge to Basilla Bridge. Muddy and vegetation habitat was found from Basilla Bridge to Amin Bazar Bridge. Sandy, muddy habitat was found from Amin Bazar Bridge to Tamanna Shishu Park and most of the muddy habitat was found from Tamanna Shishu Park to Tangi Bridge.

RESULTS AND DISCUSSION

Freshwater mollusks were assessed in the study area because of a lack of detailed surveys and basic biological information about these taxa in Bangladesh. A total of 17 species were recorded in the study area during the study period. The mollusk community was represented primarily by two classes' Gastropoda and Bivalvia. Among the 17 species, a total of 14 belonged to 12 genera, 7 families, and 5 orders. Two classes have been identified in the Buriganga River and 12 freshwater mollusk species belonging to 8 genera, 6 families, and 4 orders were found in the Turag River (Table 1) (Figure A). The gastropod fauna is represented by 10 species in the Buriganga and 7 species in the Turag River. The order Mesogastropoda is the largest in species number and is represented by 8 species of the families Viviparidae, Pilidae, Thiaridae and Lymnaeidae in the Buriganga River and by 6 species of the families Viviparidae, Pilidae, and the Thiaridae in the Turag River. The Viviparidae include three species in one genus. *Bellamya* include *B. crassa* in the Buriganga River and *B. dissimilis* in Turag River only, but *B. begalensis* was recorded from both rivers. The family Pilidae is represented by two species, *Pila globosa* and *P. virens*, which were collected in both rivers. The family Thiaridae included four genera. *Melanoides tuberculata* and *Sulcospira variabilis* were collected from the Buriganga River and *Paludomus conica* was collected from the Turag River, and *Brotia costula* occurred in both rivers. The Basommatophora order is represented by two species in two genera of the family Lamnaiedae. *Lymnea luteola* was documented in the Buriganga River only and *Indoplanorbis exustus* was observed in both rivers. The order Stylommatophora included one species *Macrochlamys sequax* in the family Ariophantida. The gastropod species *Bellamya begalensis*, *Brotia costula*, *Melanoides tuberculata* occurred in muddy, stony and sandy habitat in the Buriganga River. The bivalve fauna comprises 6 species in 4 genera, 3 families and 2 orders (Table 1).

Lamellidens marginalis, L. jenkinsianus, Parreysia corrugata were found in muddy and sandy habitat in the both rivers. *Corbicula fluminea* (O. F. Müller, 1774) was recorded from the Buriganga River and *Novaculina gangetica* documented from the Turag River. *Lamellidens jenkinsianus* and *Parreysia corrugata* are endemic to the Ganga and lower Brahmaputra River Systems. In the Barak River in India 16 species of mollusks (13 gastropods and 3 bivalve species) have been reported (Seba and Abhik 2010). Altogether 19 species (13 gastropod and 6 bivalve species) were recorded during the period from 2009 to 2010 in the Narmada Ruver, India. (Ankit and Vipin, 2012) (Table 2.) The diversity of mollusks in the Buriganga and Turag Rivervaries significantly. It should be noted that majority of the species on the list here are accepted by Prabakhar and Roy (2008). However, we have taken a morphological approach in reporting taxa; should future anatomical and molecular studies provide definitive taxonomic resolution in these groups, there will be a need to re-evaluate the

Class & Order	Family	Scientific Name	English Name	Local Name	Habit	Habitat	Distribution	Status
Gastropoda								
Stylommatophora	Ariophantiae	*Macrochlamys sequax*	Disk Snail	Chakti Shamuk	Hr	V	B	R
Mesogastropoda	Viviparidae	*Bellamya begalensis*	River Snail	Guli Shamuk	H	St, S, D	M, Sa, K, R	VC
		Bellamya crassa	Pond Snail	Guli Shamuk	H	S, D	M, Ss, K	VC
		Bellamya dissimilis	Pond Snail	Guli shamuk	H	F	Tp, Pb	R
	Pilidae	*Pila globosa*	Common Apple-snail	Shamuk	H, A	F, M, D	W, B, R	VC
		Pila virens	Apple-snail	Bara Shamuk	H, A, O	F, M	W, B, R	FC
	Thiaridae	*Melanoides tuberculata*	Screw Snail	Pachano Shamuk	S	S	Sh, N, Ba	C
		Brotia costula	Brotia snail	Lomba Shamuk	H	S, St	M, Sh, Tp, Pb	C
		Paludomus conica	Canal snail	Paba shamuk	S	F	Tp	C
Basommatophora	Lymnaeidae	*Lymnaea luteola*	Lymneid Snail	Shamuk	H	St, S	M, K	R
		Indoplanorbis exustus	Ram's Horn Snail	Gari	Hr	S, M, D	M, Sa, Tp	VC
Bivalvia								
Unionoida	Unionidae	*Lamellidens corrianus*	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, Tp, Pb	VC
		Lamellidens jenkinsianus	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, R	VC
		Lamellidens marginalis	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, Tp, Pb	VC
		Parreysia corrugata	Fresh water Mussel	Gol Jhinuk	H, C	S, M	Sh, Ba, Tp, Pb	C
Veneroidea	Cyrenidae	*Corbicula fluminea*	Asian Clam	Jhinuk	C	S, M	K, B	FC
	Solecurtidae	*Novaculina gangetica*	Ganges Clam	Lomba Jhinuk	H, C	M	Tp	C

Table 1: Mollusca in the Buriganga and Turag Rivers, Dhaka
Note: Millbarak = M, Sadarghat = Sa, Kamrangichar = K, Basilla = B, Washpur = W, Sholmasi = Sh, Nabinagar = N, Barabordasi = Ba, Rustampur = R, Tamanna park = Tp, Prothasha bridge = Pb, Hermaphroditic = Hr, Herbivorous = H, Amphibious = A, Oviparous = O, Carnivorous = C, Scavenger = S, Freshwater = F, Stony = St, Sandy = S, Muddy = M, Dust = D, Vegetation =.V. Very Common = VC, Fairly Common = FC, Common = C, and Rare = R

Specimens collected in this study as well as museum records in order to refine this list. There is currently uncertainty in mollusk taxonomy; taxonomy of some of the genera is in a highly confused state (Burch 1982); and there is extreme phenotypic variation in many groups (Dillon *et al.,* 2002; Britton and McMahon 2004). In this document, freshwater mollusks were included as part of the development of a long-term strategy for protection of these sites. This is a promising step toward the conservation of aquatic gastropods and bivalve in Buriganga-Turag Rivers and the listing of 17 species as being considered vulnerable due to water pollution and habitats loss, and larger distribution information for these taxa is certainly lacking.

Additional efforts dedicated to studying freshwater mollusks will be needed to help identify key species and populations to support these efforts. We hope that the information presented in this paper will be useful to resource managers and welcome any future refinements of this initial list.

CONCLUSION

The present study elucidated the Mollusca diversity in the study area. Long term freshwater monitoring is required to develop ongoing estimates of the abundance, populations, and for the design of conservation and management programs.

Figure: A. Freshwater mollusks in the Buriganga and Turag Rivers: 1.*Macrochlamys sequax* (Benson, 1859) (9mm), **2.** *Bellamya begalensis* (Lamarck, 1822) (22 mm), **3.** *Bellamya crassa* (Benson, 1836) (18 mm), **4.** *Bellamya dissimilis* (Müller, 1774) (21 mm), **5.** *Pila globosa* (Swainson 1882), **6.** *Pila virens* (Lamarck, 1822) (38 mm), **7.** *Melanoides tuberculata* (Müller, 1774) (32 mm), **8.** *Brotia costula* (Rafinesque, 1833) (152 mm), **9.** *Paludomus conica* (Gray, 1834) (20 mm), **10.** *Lymnaea luteola* (Lamarck, 1822) (18 mm), **11.** *Indoplanorbis exustus* (Deshayes, 1834), **12.** *Lamellidens corrianus* (Lea, 1834) (70 mm), **13.** *Lamellidens jenkinsianus* (Benson, 1862) (68 mm), **14.** *Lamellidens marginalis* (Lamarck, 1819) (76 mm), **15.** *Parreysia corrugate.* (Müller, 1774) (42 mm), **16.** *Novaculina gangetica* (Benson, 1853) (45 mm); **17.** *Corbicula fluminea* (O. F. Müller, 1774) (26 mm).

Total Species	Gastropod	Bivalve	Water Body	Reference
23	18	5	Gialova lagoon, Greece	D. Koutsoubas *et al.* (2000)
16	13	3	River Barak, India	Seba and Abhik (2010)
19	13	6	River Narmada, India	Ankit and Vipin (2012)
34	34	-	Curonian Lagoon, Baltic Sea, Russia	Dmitry Filippenko (2011)
9	7	2	River Chenab, India	K. K. Sharma *et al.* (2010)
17	11	6	Buriganga -Turag river, Bangladesh	Present Study

Table 2: Mollusks collected from different rivers based upon the present study and literature reports.

ACKNOWLEDGEMENTS

The authors thank Chair and Professor Dr. Md. Saiful Islam, Department of Zoology, Jagannath University, Dhaka-1100 for his encouragement during the study. The Biodiversity Conservation & Fisheries Research Center also provided assistance for the field surveys. This study was supported by Jagannath University research grants for 2012-2013 and special allocation research fund for 2013 from Ministry of Science and Technology, Bangladesh. We are grateful to an anonymous reviewer, and David P. Berschauer for great efforts and all the helpful suggestions on improving this article.

REFERENCES

Baillie, J.E.M., C. Filton-Taylor, and S.N. Stuart. 2004. IUCN Red List of Threatened Species. A Global Species Assessment. IUCN, Gland and Cambridge. UK.

Bauer, G. 2001. Life history variation on different taxonomic levels of naiads. In: Ecology and Evolution of the Freshwater Mussels Unionoida. Ecological Studies No. 145:83-91.

Bogan, A.E. 1993. Freshwater bivalve extinctions (Mollusca : Unionoida) : a search for causes. American Zoologist. 33:599-609.

Burch, J.B. 1982. North American Freshwater Snails: identification keys, generic synonymy, supplemental notes, glossary, references, index, Walkerana 1(4):148.

Britton, D.K. and R. McMahon. 2004. Environmentally and genetically induced shell-shape variation in the freshwater pond snail *Physa* (*Physella*) *virgata*. American Malacological Bulletin 19(1/2): 93-100.

Dillon R.T., R.J.M. Wethington, and T.P. Smith. 2002. Populations of the European freshwater pulmonate *Physa acuta* are not reproductively isolated from American *Physa heterostropha* or *Physa integra*. Invertebrate Biology. 121:226-234.

Drechsler M., B.B. Lamont, M.A. Burgman, H.R. Akcakaya, E.T.F. Witkowski & Supriyadi. 1999. Modelling the persistence of an apparently immortal Banksia species after fire and land clearing. Biological Conservation. 88: 249-259.

Filippenko, D. 2011. Fauna of gastropod molluscs in the Curonian Lagoon littoral biotopes (Baltic Sea, Kaliningrad region, Russia) Malacologica Bohemoslovaca , 10: 79–83.

Frest, T.J. and E.J. Johannes. 1993. Mollusk species of special concern within the range of the northern spotted owl. Final Report to Forest Ecosystem Management Working Group, USDA

ISSN 0738-9388

Forest Service. Deixis Consultants, Seattle, Washington. 98 pp.

Frest, T.J. and E.J. Johannes 1999. Field Guide to Survey and Manage Freshwater Mollusk Species. USFWS Regional Ecosystem Office and the USDI BLM Oregon State Office, both in Portland, Oregon. 1-112 pp.

Hellawell J.M. 1986. Biological Indicators of Freshwater Pollution and Environmental Management. London: Elsevier Applied Science Publishers. London & New York: xiii + 518 pp.

Koutsoubas, D., C. Arvanitidis, C. Dounas and L. Drummond. 2000. Community structure and dynamics of the Molluscan Fauna in a Mediterranean Lagoon (Gialova Lagoon, SW Greece). Belg. J. Zool., 130 (Supplement 1):131-138.

Kumar, A. and V. Vyas. 2012. Diversity of Molluscan communities in River Narmada, India. Journal of Chemical, Biological and Physical Sciences. 2(3):1407-1412.

Lydeard, C., R.H. Cowie, W.F. Ponder, A.E. Bogan, P. Bouchet, S.A. Clark, K.S. Cummings, T.J. Frest, O. Gargominy, D.G. Herbert, R. Hershler, K.E. Perez, B. Roth, M. Seddon, E.E. Strong & F.G. Thompson. 2004. The global decline of nonmarine mollusks. Bioscience, 54:321-330.

Nedeau, E. J., A.K. Smith, J. Stone, and S. Jepsen. 2009. Freshwater Mussels of the Pacific Northwest Second Edition. The Xerces Society for Invertebrate Conservation. 51 pp.

Nordstrom, W. 2003. Mollusc Records from Colin-Cornwall Lakes Wildland Park. Alberta Natural Heritage Information Centre. Parks and Protected Areas Division Alberta Community Development. 1-11 pp.

Norman, M.D. 1998. Octopodidae (Benthic octopuses). In: Carpenter, K.E. and Niem, V.H. (eds.), FAO species Identification Guide for Fishery Purposes. The Living Marine Resources of the western Central Pacific. Vol. 2. Rome, FAO. pp. 800-826.

Petts, G.E., H. Moller, and A.L. Roux. 1993. Historical Change in Large Alluvial Rivers. Western Europe. Chichester: John Wiley and sons ltd. 1989. 355 pp.

Prabhakar, A.K. and S. P. Roy. 2008. Taxonomic Diversity Of Shell Fishes Of Kosi Region Of North-Bihar (India). The Bioscan. 2 (2):149-156.

Primack, R.B. 2002. Essentials of Conservation Biology, Third Edition. Sinauer Associates, Sunderland, MA.698 pp.

Raimondo D.C. and J.S. Donaldson. 2003. Responses of cycads with different life histories to the impact of plant collecting: simulation models to determine important life history stages and population recovery times. Biological Conservation.111:345-358.

Richter, B.D., J.V. Baumgartner, R. Wigington, and D.P. Braun. 1997. How much water does a river need? Freshwater Biology. 37:231–249.

Rosenberg, D.M. and V.H. Resh (Eds). 1993. Freshwater Biomonitoring and Benthic Macroinvertebrates. Chapman and Hall, New York, NY. 488 pp.

Sharma, K.K., S. Chowdhary and A. Sharma. 2010. Malacofuana diversity of river chenab fed stream (gho-manhasan). The Bioscan. 6(2): 267-269.

Seba, R. and A. Gupta. 2010. Molluscan Diversity in River Barak and its Tributaries, Assam, India. Assam University Journal of Science & Technology: Biological and Environmental Sciences. 5(I):109-113.

Siddiqui, K.U., M.A. Islam, S.M.H. Kabir, A.T.A. Ahmad, A.K.A. Rahman, E.U. Haque, Z.U. Ahmad, Z.N.T. Begum, M.A. Hassan, M. Khondker, M.M. Rahman. (Eds.) 2007. Encyclopedia of flora and fauna of Bangladesh, Vol. 17, Mollusks. Asiatic Society of Bangladesh, Dhaka, 415 pp.

Stark, E.J. 2001. Effects of Water Level Fluctuations on Benthic Macroinvertebrates in the Hanford Reach, Colubmia River. Master's Thesis, University of Idaho, Moscow, Idaho.

Stearns, S. C. 1992. The evolution of life histories. Oxford University Press, Oxford. 239 pp.

Supian, Z. & A.M. Ikhwanuddin. 2002. Population dynamics of freshwater molluscs (Gastropod: *Melanoides tuberculata*) in Crocker Range Park, Sabah. ASEAN Review of Biodiversity and Environmental Conservation (ARBEC).

Wheeler, B.A., E. Prosen, A. Mathis, & R.F. Wilkinson. 2003. Population declines of a long-lived salamander: a 20+-year study of hellbenders, *Cryptobranchus alleganiensis*. Biological Conservation, 109:151-156.

Wilson, E.O. 1989. Threats to biodiversity. Scientific American, 261:108-115.

ISSN 0738-9388

Some cone shells with nodules that persist at least into the middle whorls (subfamilies Conilithinae and Coninae) from the East Pacific region

John K. Tucker
Illinois Natural History Survey (Retired)
731 Cantonment, Rantoul, Illinois 61866
johntucker@gtewc.com

INTRODUCTION

In the first installment of this series, five species of spotted cone shells were considered. In this paper eleven other species are detailed. These include those species that have nodules along the shoulder angle and where the nodules reach the middle spire whorls. Most of these species actually retain nodules along the shoulder angle throughout growth. All of these species were considered in detail in the comprehensive volume on all of the East Pacific cone shell species (*i.e.,* Tenorio *et al.*, 2012) use of this book will help establish species identities for all of these species.

Even though the taxonomy of East Pacific cone shells is relatively stable, some problem areas seem to remain. The figure captions are designed to point out the difficulties along with useful key-characters for species identifications. Complete species descriptions are available along with comprehensive illustrations in Tenorio *et al.* (2012). Those interested in the East Pacific cone shells should consult that book.

REFERENCES

Duda Jr., T.F., M.B. Bolin, C.P. Meyer, & A.J. Kohn. 2008. Hidden diversity in a hyperdiverse gastropod genus: discovery of previously unidentified members of a *Conus* species complex. Molecular Phylogenetics and Evolution 49:867-876.

Nybakken, J. 1970. Radular anatomy and systematics of the West American Conidae (Mollusca, Gastropoda). American Museum Novitates 2414:1-29.

Nybakken, J. 1978. Population characteristics and food resource utilization in *Conus* in the Galapagos Islands. Pacific Science 32:271-28.

Nybakken, J. 1979. Population characteristics and food resource utilization in *Conus* in the Sea of Cortez and West Mexico. Journal of Molluscan Studies 45:82-97.

Tenorio, M.J., J.K. Tucker, & H.W. Chaney. 2012. A Conchological Iconography:The Families Conilithidae and Conidae. The Cones of the Eastern Pacific. ConchBooks, Hackenheim, Germany, 112 pp.

Tucker, J.K. 1979. *Conus bartschi* and *Conus brunneus*: two closely related eastern Pacific cone shells. Shell Collector Magazine 2:42-43.

Tucker, J.K. & J.H. McLean. 1993. The rediscovery, morphology, and identity of *Conus emersoni* Hanna, 1963. The Nautilus 107:29-32.

Tucker, J.K. & M.J. Tenorio. 2009. Systematic Classification of Recent and Fossil Conoidean Gastropods, with Keys to the Genera of Cone Shells. ConchBooks, Hackenheim, Germany, 296 pp.

Tucker, J.K. & M.J. Tenorio. 2013. Illustrated Catalog of the Living Cone Shells. MdM Publishing, Wellington, Florida, iv + 517 pp.

ISSN 0738-9388

Descriptive figure captions: Figures 1 to 3 illustrate images of the East Pacific cone shells that have nodulose shoulder angles with images from Tucker & Tenorio, 2013. Figures 1 to 5 represent the species of *Virroconus* from the East Pacific (Tucker & Tenorio, 2009).

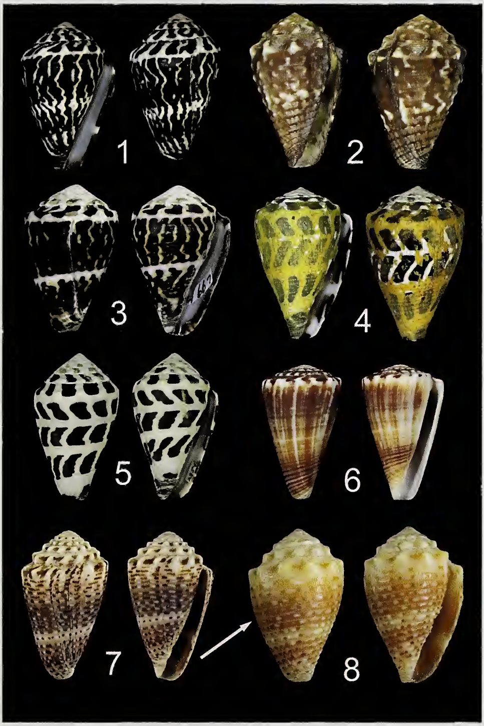
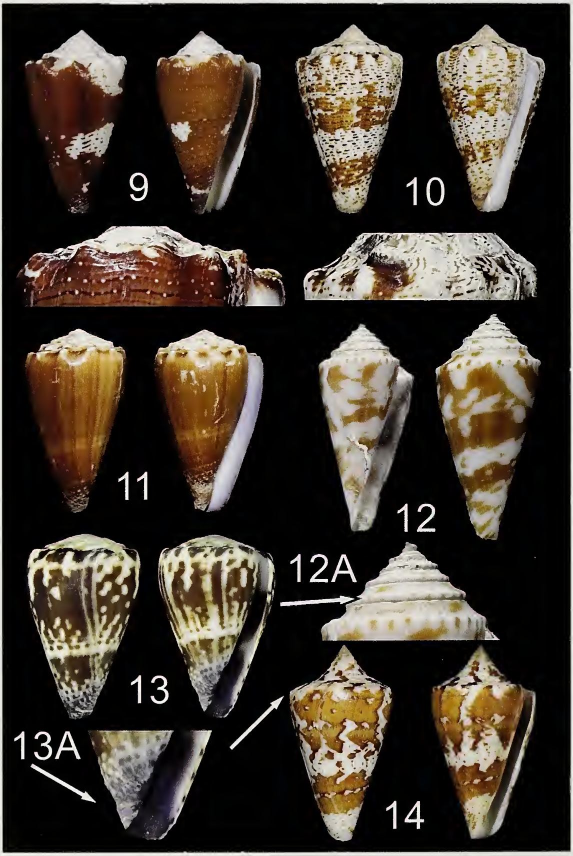


Figure 1. Specimen of *Virroconus chaldaeus* (SBMNH 99965). 35.7 mm shell length, from Clipperton Island. **Figure 2.** Holotype of *Conus brunneus pemphigus* Dall, 1910, (USNM 37449), 26 mm shell length, from Ilas Tres Marias, Nayarit, Mexico. Tenorio *et al.* (2012) pointed out that Dall's specimen is actually a specimen of *V. chaldaeus* and that *Conus brunneus pemphigus* is a synonym of *V. chaldaeus.* **Figure 3.** An Indo-Pacific specimen of *Virroconus chaldaeus* (INHS 45013), 26.2 mm in shell length, from Hundred Islands, Lingayen Gulf, Luzon, Philippines, which was illustrated by Tucker & Tenorio (2013); shown here for comparison with the East Pacific *V. chaldaeus* in Figure 1. The spires of East Pacific specimens are slightly but statistically significantly higher than are the spires of their Indo-Pacific counterparts. More interesting and possibly diagnostic are differences in the radular teeth of the East Pacific and Indo-Pacific specimens. The latter has slight but distinctly developed serrations on the tooth (see Figures 28 and 28A). The radulae from the East Pacific specimens do not have serrations (see Figures 29 and 29A). However, few samples of the Indo-Pacific *V. chaldaeus* have been examined and previous illustrations of radulae of Indo-Pacific specimens do not show the serrations that Tenorio *et al.*, 2012, reported for *V. chaldaeus* from the Seychelles. This may be due to the small and indistinct nature of the serrations in the Indo-Pacific specimens leading to them being overlooked. **Figure 4.** An East Pacific specimen (LACM 72-68.9) of *Virroconus ebraeus*, 37 mm in shell length, from Isla del Cano, Costa Rica with a portion of the periostracum preserved. **Figure 5.** An Indo-Pacific specimen of *V. ebraeus* (INHS 44784), 38.1 mm shell length, from Cebu Island, Philippines shown for comparison with those from the East Pacific. **Figure 6.** A specimen of *Gladioconus gladiator* (MJT collection), 36.7 mm in shell length, from Playa Maculis, El Salvador. **Figures. 7 and 8.** Specimens of *Miliariconus tiaratus*. Figure 7 is the normal form of the species, shell length is 45.7 mm (SBMNH 90852) and came from Isla Bartolome, Galapagos; Figure 8 is the holotype (USNM) of the form *roosevelti*, shell length of 15.3 mm, from Clipperton Island. Specimens of this form are wider bodied than the nominate form (note arrow) and have pink interiors, whereas the nominate form has either white or purple interior coloration.

ISSN 0738-9388

Figures 9 to 14 illustrate a number of images of more nodulose species.



Figures 9-11, and 14. Four brown cone species. **Figure 9.** *Stephanoconus brunneus* (MJT collection), 33.0 mm shell length, from Isla Gobernadora, Panama. This species has at least 5 cords on the spire whorl tops. The other three species (Figures 10, 11 and 14) have fewer (2 or 3 for *Lividoconus diadema*) or have the whorl tops that are smooth as for *S. bartschi* and *Tenorioconus archon*. Like *S. bartschi* (Figure 23) and *T. archon* (Figure 24), *S. brunneus* (Figure 22) has the typical short thick and spiny radular morphology associated with predation on amphinomid polychaetes (see Tenorio *et al.*, 2012). In contrast, *L. diadema* has a thin elongated tooth that has no serrations but does have a terminating cusp (Figure 25; Tenorio *et al.*, 2012). *Lividoconus diadema* feeds on a variety of other polychaetes (Nybakken, 1978 and 1979). **Figure 10.** *Stephanoconus bartschi* (MJT collection), 45.4 mm shell length, collected south of Acapulco, Copala region, Mexico. This species has the radula and general shell morphology similar to *S. brunneus*. In general, *S. bartschi* is lighter colored than the usually darker brown coloration of *S. brunneus*. However, shell color is not the identifying criteria for *S. bartschi*. Rather it is the lack of cords on the whorl tops of *S. bartschi*. In contrast, the whorl tops of *S. brunneus* have at least

5 well developed cords (Tucker, 1979). **Figure 11.** *Lividoconus diadema* (MJT collection), 38.7 mm shell length, Las Perlas, Panama. Specimens of *L. diadema* are most often confused with 'clean' specimens of *S. brunneus*. Besides differences in radular teeth (compare Figures 22 and 25), the structure of the whorl tops are completely different. *Stephanoconus brunneus* has at least five and often more cords on the spire whorl tops (Figure 9). The spire whorl tops of *L. diadema* have two to sometimes 3 grooves on the whorl tops. These grooves often fade in outer whorls. Besides this highly reliable difference in whorl top structure, these species also differ in the structure of the operculum and periostracum. In the *Stephanoconus* species (*S. brunneus* and *S. bartschi*) the operculum is relatively large and the periostracum is smooth. The operculum of *L. diadema* is small and the periostracum is tufted along the shoulder angle and often on the body whorl as well. **Figure 12.** *Profundiconus emersoni* (LACM 146906), 33.7 mm shell length, collected in 300 m off Isla Santa Maria (Charles), Galapagos Islands. This species is the only member of the Family Conilithidae included here; all of the other species belong in the family Conidae, subfamily Puncticulinae. It is included in this section because the small square shaped nodules (*see* arrow in Figure 12A) of *P. emersoni* that usually persist into the outer spire whorls. The nodules are arranged along a carina and are probably not homologous with the nodules in the Conidae included here. The nodules of the Conidae are arranged along the shoulder angle but they are not square shaped and are not associated with a carina; they are hemispherical in shape instead. The operculum of *P. emersoni* is unique among East Pacific cone shells. It is serrated along its inner margin and relatively large. Other Indo-Pacific species of *Profundiconus* (e.g., *P. teramachii*) also have large serrated opercula (Tucker & McLean, 1993; Tucker & Tenorio, 2013). These observations are summarized in Tucker & McLean (1993). **Figure 13.** *Harmoniconus nux* (INHS 45028), 22.5 mm in shell length, collected from Clipperton Island. Some associate this unique cone shell with *H. sponsalis* or *H. nanus*, both Indo-Pacific species of *Harmoniconus*. Tenorio *et al.* (2012) outlined differences in shell parameters between *H. nux* and *H. sponsalis*. Moreover, Duda *et al.* (2008) showed that *H. nux* represents a reproductively isolated evolutionarily significant unit, which supports its recognition as a separate species from Indo-Pacific species of *Harmoniconus*. **Figure 14.** *Tenorioconus archon* (MJT collection), 45.6 mm in shell length, from Isla Canal de Afeura, Panama. This species of *Tenorioconus* differs from the two species of *Stephanoconus* in the nature of the periostracum. It is smooth in *Tenorioconus* but tufted or ridged in *Stephanoconus*. These genera also differ in the persistence of the nodules. In the *Tenorioconus* the nodules fade out well before middle spire whorls. These are well developed in the early whorls and the spire tends to be convex in profile. Nodules of the *Stephanoconus* species persist. Finally the operculum of *T. archon* is relatively small compared to the larger one present in the East Pacific *Stephanoconus* species.

Figures 15 to 17 illustrate the *Ductoconus princeps* variants. This species is quite variable in the coloration of the longitudinal lines that may be or may not be present on the body. Besides these variants, the species is easily distinguished from other nodulose species by the constant orange to pink coloration of the body and spire. The narrow elongated radular tooth (Figure 28) is also diagnostic. Among the other nodulose cone shells, only *L. diadema* has an elongated radular tooth. However, that species does not have well developed serrations that extend for more than half the length of the tooth (compare Figures 25 and 28). The operculum of *D. princeps* is fairly large and the periostracum is thick and has rows of pronounced tufts on the body.

Figures 18 to 30 illustrate radulae of the nodulose East Pacific cone shells. See Tenorio *et al.* (2012) for details on scales and sources.

Editor's Note: *The Festivus* is accepting articles for future issues. Articles of a scientific nature may be submitted for the peer reviewed portion of our journal. Please refer to our Guidelines for Authors, and/or Guidelines for the Description of New Taxa in *The Festivus*, both available on our website: http://www.sandiegoshellclub.com/festivus/ Articles are subject to a blind peer review process, and submission of an article does not guarantee acceptance or publication. We also accept articles of general interest to malacologists, conchologists and shell collectors for publication in the general interest section of our journal. All articles must be accompanied by either the author's original artwork, or a signed copyright waiver from the copyright holder.

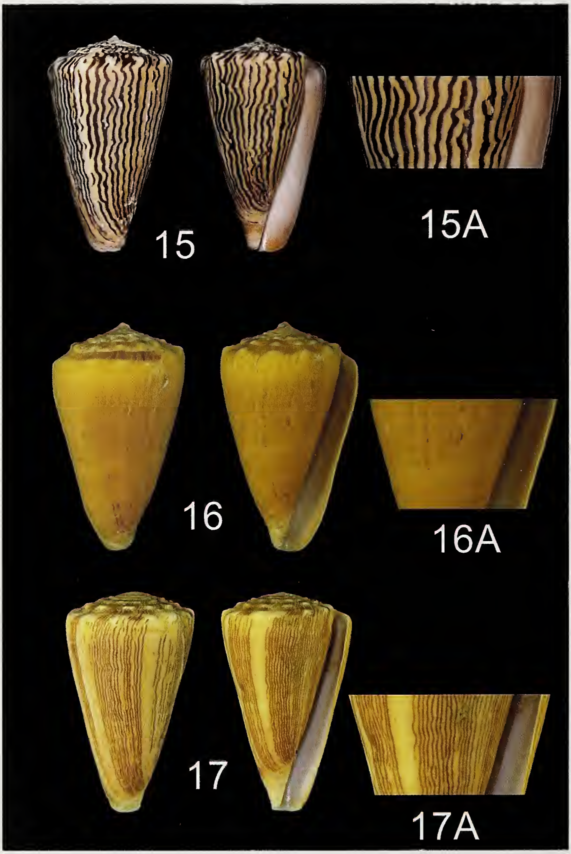


Figure 15. *Ductoconus princeps* variety *princeps* (MJT collection), shell length is 66.6 mm, collected from Guaymas, Sonora, Mexico. The nominate variety is characterized by the well-spaced fairly wide longitudinal lines (Figure 15A). **Figure 16.** *Ductoconus princeps* variety *apogrammatus* (INHS 45027), shell length is 52.0 mm, collected from Isla Gobernadora, Golfo de Montijo, Panama. This variety has little or no development of the longitudinal lines (Figure 16A). **Figure 17.** *Ductoconus princeps* variety *lineolatus* (INHS 45026), shell length 58.8 mm, trawled in 15 to 20 m, Panama Bay, Panama. This variety has the longitudinal lines closely spaced and they are quite narrow (Figure 17A). It often occurs with variety *apogrammatus* in Panama but any of the varieties can occur together.

ISSN 0738-9388

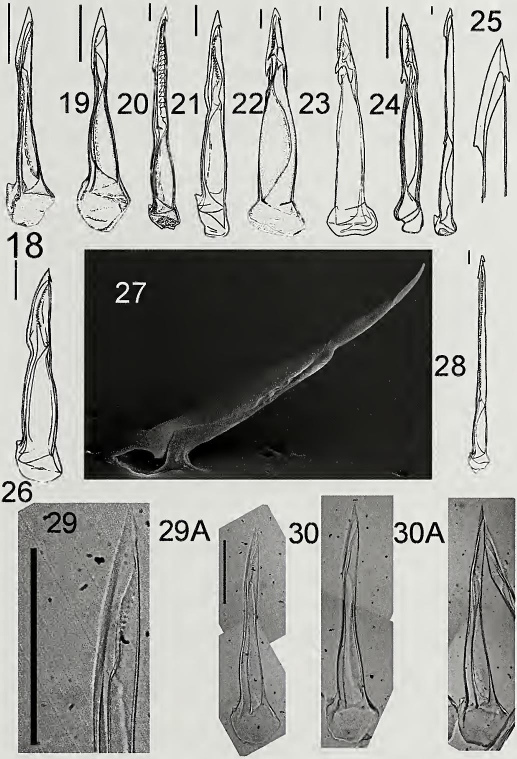


Figure 18. *Virroconus chaldaeus*, SBMNH 358607, Clipperton Island, Shell length (S_L) = 38 mm, Tooth length (T_L) = 0.37 mm. **Figure 19.** *Virroconus ebraeus*, SBMNH 358606, Clipperton Island, S_L = 44 mm, T_L = 0.39 mm. **Figure 20.** *Gladioconus gladiator*, Las Tunas, El Salvador, S_L = 38.4 mm, T_L = 1.36 mm. **Figure 21.** *Miliariconus tiaratus*, Golfo de Panama, S_L = 22.4 mm, T_L = 0.73 mm, from Nybakken, 1970. **Figure 22.** *Stephanoconus brunneus*, Golfo de Panama, S_L = 41.3 mm, T_L = 1.62 mm., from Nybakken, 1970. **Figure 23.** *Stephanoconus bartschi*, Golfo de Panama, S_L is unknown, T_L = 1.2 mm, from Nybakken, 1970. **Figure 24.** *Tenorioconus archon*, Golfo de Panama, S_L = 41.3 mm, T_L = 0.43 mm, from Nybakken, 1970. **Figure 25.** *Lividoconus diadema*, Islas Galapagos, S_L = 44.8 mm, T_L = 1.57 mm. **Figure 26.** *Harmoniconus nux*, Golfo de Panama, S_L = 20.8 mm, T_L = 0.54 mm, from Nybakken, 1970. **Figure 27.** *Profundiconus emersoni*, scanning electron micrograph, LACM 146906, Islas Galapagos, off Isla Santa Maria; S_L = 33.7 mm, T_L = 0.4 mm. **Figure 28.** *Ductoconus princeps*, Golfo de Panama, S_L = 37 mm, T_L = 1.6 mm, from Nybakken, 1970. **Figure 29.** *Virroconus chaldaeus* from Mahe, Seychelles (Y36-5251), light micrograph. Close up showing serrations and Figure 29A showing the entire tooth length also from Mahe, Seychelles; S_L = 30 mm, T_L = 0.35 mm. **Figure 30.** *Virroconus chaldaeus* from Clipperton Island (SBMNH 358607), light micrograph. Close up showing lack of serrations and Figure 30A showing the entire tooth length; S_L = 38 mm, T_L = 0.37 mm.

ISSN 0738-9388

Volume: 48 THE FESTIVUS ISSUE 4

A new subspecies of *Amphidromus* (*Goniodromus*) *bulowi* Fruhstorfer, 1905 (Gastropoda: Pulmonata: Camaenidae) from Sumatra, Indonesia

Jeff Parsons [1] and John Abbas [2]

[1] 47 Elizabeth Street, Aitkenvale, Queensland, Australia 4814
jeffonese@yahoo.com.au

[2] Lihue, Kauai, Hawaii, and Jalan Demaga Baru, Muara Angke,
Jakarta Utara Pos 14450, Jakarta, Indonesia john123abba@yahoo.com

ABSTRACT Since its discovery, the rare arboreal land snail *Amphidromus* (*Goniodromus*) *bulowi* Fruhstorfer, 1905 has only been found on the forested slopes of Mount Singgalang, West Sumatra. In 2013, a survey of the forests in western Malalak District of West Sumatra located a new population on Bukit Pandan, which is described herein as *Amphidromus* (*Goniodromus*) *bulowi malalakensis* new subspecies. The new subspecies has a dextral whitish shell with a pale grey and/or light buff to tawny open-tent pattern instead of brown, and lacks the creamy, purplish- or pinkish-brown undertones of the amphidromine nominotypical subspecies.

KEY WORDS Malalak District, Agam Regency, *Amphidromus*, *Goniodromus*, *bulowi*, *malalakensis*, new subspecies.

INTRODUCTION

Late 2008, John Abbas was made aware of *Amphidromus* (*Goniodromus*) *bulowi* Fruhstorfer, 1905 by Jamie Powers of Edgewater, Florida. This resulted in a trip to the foothills of Mt. Singgalang, West Sumatra to locate this species, 200 m above the type locality of Pandai Sikek. Unfortunately, Pandai Sikek is now a sizable village with much of the low altitude forest transformed for agriculture by the villagers, which has removed the forest mentioned by Rolle (1908) at 4000 to 5000 ft. (1219 to 1524 m) altitude. Sugarcane is the main crop grown and the fields stretch a few hundred metres up from the base of Mt. Singgalang. Even after employing a few villagers, only one specimen was located on the first visit to the area.

Various factors contribute to the difficulty in locating *A.* (*G.*) *bulowi* on Mt. Singgalang. Birds prey on snails on the trees and any fallen snails may be eaten by pigs and rodents foraging below. The main factor is shrinking habitat due to agricultural deforestation and forest fires set intentionally by villagers to assist in clearing and for fertilizer. Logging for wood, whether used for housing, furniture or paper, further deforests this mountain. After a few more trips to Mt. Singgalang each year until October 2013 only a limited number of specimens were found, so John chose to explore other areas adjacent to and beyond Mt. Singgalang.

In November 2013, John visited the outer slopes in the south-eastern part of the Lake Maninjau caldera. A colony of snails identified as pale coloured *A.* (*G.*) *bulowi* was located on Bukit

ISSN 0738-9388

Pandan, western Malalak District, some 15 kilometres west of Pandai Sikek. Both Fruhstorfer (1905) and Rolle (1908) never mentioned anything about Malalak. The road dividing west and east Malalak is now sealed, making the area more accessible. A more recent trip by Steven Lie to western Malalak to locate more specimens of these snails came up empty as local farmers had cleared more forest using the slash-and-burn technique. The Bukit Pandan snails are distinguishable from the nominotypical subspecies by shell coloration, and described herein as *A.* (*G.*) *bulowi malalakensis* new subspecies.

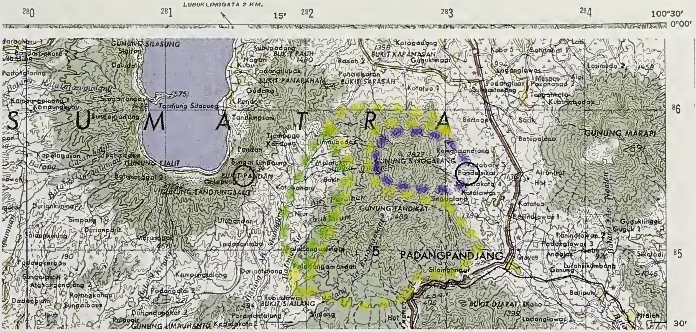


Figure 1. Location map for both subspecies: *A.* (*G.*) *bulowi malalakensis* n. ssp. (red circle = type locality), *A.* (*G.*) *b. bulowi* (blue circle = type locality, blue dotted line = known range and yellow dotted line = predicted range) and predicted extent of a previous contact zone (green dotted line). Modified from a 1954 map of "Pandang, Sumatra" [contour interval 100 m with supplementary contours at 50 m intervals] (University of Texas Libraries, 2014).

METHODS AND MATERIALS

Type material has been deposited in the Natural History Museum, London, England, UK and Muséum National d'Histoire Naturelle, Paris, France; and three paratypes belong to the private collections of the authors, Jeff Parsons (1 shell) and John Abbas (2 shells). The subspecies description was determined from shell morphology of dry empty shells obtained by John Abbas. Comparative material comprised of shells from the private collections of the authors, and images of type shells from the literature. Photography credits are as indicated below each image. Relative shell sizes for the subgenus *Goniodromus* Bülow, 1905 mentioned are as follows: small < 35 mm, medium 35–55 mm and large > 55 mm.

Shell sculpture was examined under low magnification (10x) using a jeweller's loupe. Most shells examined had formed a thickened adult lip, and only one had a thin subadult lip. All shells were measured for shell height and shell width including the reflected lip, using digital vernier callipers with a resolution of 0.01 mm. Whorl count includes the apex as per Haniel (1921, p. 22, fig. 10) and counted precise to 0.125 (⅛ whorl). The ratios of shell height to shell width (H/D) were calculated as indices of

shell shape. Shell weight was measured in grams (g) using a pocket-sized electronic scale (capacity 300 g x 0.01 g). Measurement of the perch angle (PA) follows Dharma (2007). The term 'paries' (adj. parietal) refers to the 'inner apertural wall', and 'palatum' (adj. palatal) refers to the interior surface of the 'outer apertural wall'.

Taxonomic and other remarks

Bülow (1905) established *Goniodromus* as a new subgenus of *Amphidromus* Albers, 1850 on page 83 prior to Fruhstorfer's paper in the same journal issue. Fruhstorfer (1905) by default selected and named the type species after Bülow as *Amphidromus* (*Goniodromus*) *Bülowi*. Laidlaw and Solem (1961) incorrectly stated on page 606 that Fruhstorfer established this species as *Amphidromus bülowi*, *i.e.* without using *Goniodromus* as the subgenus, and they also use this spelling with the diacritic on pages 587 and 589. The current International Commission on Zoological Nomenclature code (ICZN, 1999) does not allow the use of diacritics in a species name (Articles 11.2 and 27) and such names must be corrected (Article 32.5.2), therefore the accepted spelling is *A.* (*G.*) *bulowi.*

Please note that the spellings of the locality names used by Rolle (1908) are correct for the Dutch era, and since independence, the Indonesian government has changed them. Padang Sikeh is now Pandai Sikek and Vulkans Singalang is now Gunung Singgalang.

Abbreviations used for museums and private collections:
CNHM = Chicago Natural History Museum
NHMUK = Natural History Museum, London, England, UK
MNHN = Muséum national d'Histoire naturelle, Paris, France
JA = John Abbas collection
JP = Jeff Parsons collection

Abbreviations for shell morphometry:
D = shell width (the abbreviation aligns with the usage of 'diameter' in the literature)
H = shell height
H/D = shell height/shell width ratio
N = whorl count
PA = perch angle
W = shell weight

SYSTEMATICS

Class Gastropoda Cuvier, 1795
Family Camaenidae Pilsbry, 1895
Genus *Amphidromus* Albers, 1850
Subgenus *Goniodromus* Bülow, 1905
Type = *A.* (*G.*) *bulowi bulowi* Fruhstorfer, 1905

Amphidromus (*Goniodromus*) *bulowi malalakensis* new subspecies
Figs. 2, 3, 4 top and 6C

Type Material: 5 adult shells, all dextral; Holotype (Figure 2): NHMUK 20140066, H 52.10 mm, D 26.10 mm, H/D 2.00, N 7.00 and PA 20.13°; Paratypes (4 shells): Paratype 1 (Figure 3A) MNHN IM-2012-2717, H 52.00 mm (protoconch missing), D 26.10 mm, H/D no data, N 6.00 (calculated) and PA 23.10°; Paratype 2 JP (Figures 3B & 6C) H 53.50 mm, D 26.11 mm, H/D 2.05, N 6.625, W 4.01 g and PA 19.10°; Paratype 3 JA (Figure 3C), H 52.65 mm, D 26.50 mm, H/D 1.99 and PA 24.58°; Paratype 4 JA (Figures 3D & 4 top snail), H 48.47 mm, D 24.10 mm, H/D 2.01 and PA 20.58°.

Other material examined: 4 adult shells, all dextral (Figures 3E-H); H 50.87–51.86 (av. 51.43) mm, D 26.20–27.00 (av. 26.58) mm, H/D 1.92–1.95 (av. 1.94) and PA 19.42–26.66° (av. 21.87°).

ISSN 0738-9388

Type Locality: Bukit Pandan western Malalak District, Agam Regency, West Sumatra, Indonesia at an altitude of 1389 metres. (Figure 1)

Distribution: currently known only from the type locality; possibly found on other peaks with the same vegetation on the rim of the Maninjau Caldera.

Habitat: found about three metres above the ground on the trunks of trees in a bushy form of submontane forest with *Pandanus*, ferns and herbs.

Animal: mid-body and often the neck are flesh-pink; head, foot and sometimes neck flesh-pink sprinkled with yellowish-orange or reddish-orange granules; mid-dorsal stripe dark grey and narrow to wide, sometimes faint, continuing onto the face; optic and sensory tentacles yellowish-orange; tail flesh-pink with yellowish-orange or reddish-orange margins and tip; mantle and sole not seen.

Etymology: named after the Malalak District where this new subspecies was discovered.

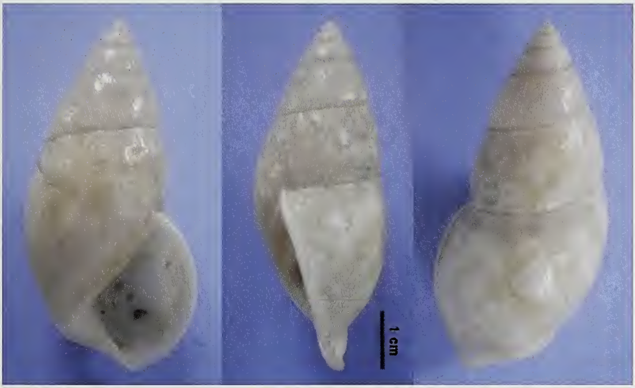


Figure 2. *Amphidromas* (*G.*) *bulowi malalakensis* n. ssp., holotype NHMUK 20150226 (Photos by John Abbas).

Description (holotype)

Shell imperforate, medium, dextral, robust and subfusiform-conic with a moderately long spire. Surface shiny; early whorls worn smooth; lower teleoconch microsculpture of crowded spiral microstriae crossed by fine growth lines; and a macrosculpture of growth threads becoming coarser and more numerous on the last, and overlaid with random or pattern forming malleations. Whorls steadily decrease in convexity and almost flat above the periphery on the last 1.5 whorls. Last whorl not descending in front; its base tapered and compressed obliquely into a strongly protuberant keel, margined by a cord above.

Suture scarcely impressed and periostracum straw-yellow, very faint.

Protoconch of 1.5 whorls, chalk-white and obtuse-conical, demarcated by a stria and ridgelet; apex slightly protruding. Teleoconch translucent greyish-white grading to chalk-white on the last; and an obsolescent white infrasutural fillet on the early whorls. Lower whorls marked with a tawny reticulate pattern and several opaque grey resting lines, representing former lips; circumcolumellar band white.

Aperture subvertical, subelliptical; base canaliculated and effuse. Palatum gleamy white, translucent and weakly shows the external pattern. Parietal callus colourless, thinly glazed over a buff-yellowparies. A parieto-labral tuberclead joins the posterior outer lip

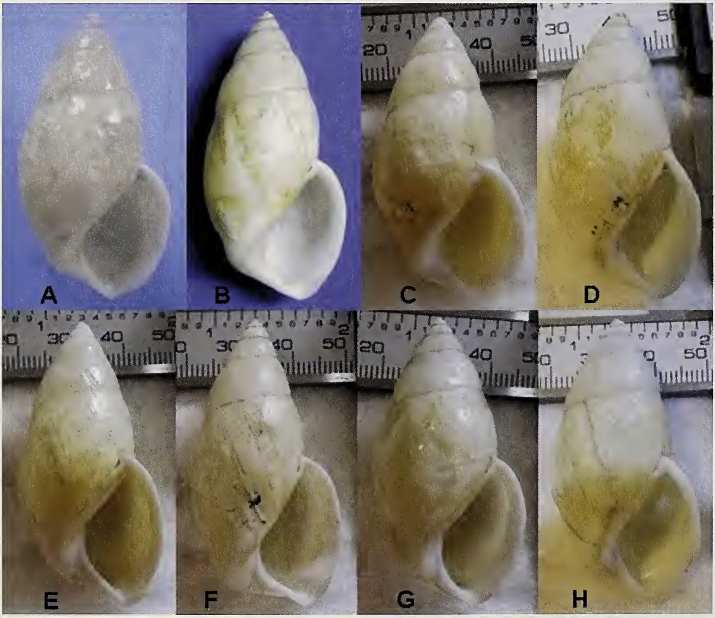


Figure 3. Variation of *A.* (*G.*) *b. malalakensis* n. ssp. with the 4 paratypes in the top row: **A** paratype 1, **B** paratype 2, **C** paratype 3 and **D** paratype 4. **E**, **F**, **G**, and **H** other material examined. (Photos by John Abbas).

termination; cord of white callus, elongate and extends internally for 3 to 5 mm, faintly grooved along its posterior edge. Outer lip white, broadly reflexed and face rounded; anteriorly flared and flattened toward a shallow notch below, forming a spout (rostrum); edge not recurved and posterior termination slightly ascending. Columella thickened and narrow, upper part vertical; base bent adaperturally, forming a basal lip. Columellar margin callused, forming an adherent shield over part of the keel (columellar callus); outer edge thickened. Umbilicus sealed.

Shell Variation

Subspecies is currently known only from dextral shells with a white ground and grey and/or yellowish-brown markings (Figure 3). Hue intensity of the paries varies from buff-yellow (Figure 6B) to cinnamon-buff. Of 9 shells none are patternless and one has a light buff super medial band on the early teleoconch whorls (Figure 3C). Pattern varies: primary markings are pale grey and/or light buff to tawny irregular, zigzag and/or branching lines and streaks, sometimes interrupted but regularly anastomosing, demarcating "tents" of ground colour and occasionally bordered with white lines. Sometimes random fleshy-ochre or tan longitudinal streaks occur as secondary markings. Ground colour does not vary between shells, although lighting and viewing angle may suggest a yellowish tint ventrally (Figures 3C-D). Live snails tend to have a whitish coating on the periostracum that is lost when cleaned (Figure 4 top snail).

Rostrum varies in extension and depth depending on the angle and protrusion of the keel. The bent base of the columella is longer than the top part in all specimens. Often the margin of the parietal callus is thickened, connecting it to the thickened margin of columellar callus. The columella's root is weakly grooved or not. No juveniles were found to demonstrate if an umbilicus is present or not. Aperture is narrow to moderately wide and oblong, subtrapezoid (Figure 6C) or subelliptical (Figure 2) at a ratio of 3:4:2. Back of the outer lip is white as per its face. Shell shape varies with angulation of the basal keel. The parieto-labral tubercle is long in all shells and in mature specimens elongates along the parietal callus margin to form an "L" shaped lump when viewed from above.

Figure 4. Live *A.* (*G.*) *b. malalakensis* n. ssp. (paratype 4, top snail) compared with *A.* (*G.*) *b. bulowi* from Mt. Singgalang (bottom snail) (Photo by John Abbas).

Comparison Material Examined:

A. (*G.*) *bulowi bulowi*
Nominotypical subspecies
Figs. 4 bottom, 5, 6A, 6B, 6D and 7

Type material: figured images of 2 out of 4 shells from the type series; H 55–60 mm (Fruhstorfer, 1905); Lectotype: sinistral, NHMUK 1910.12.30.98 (Figure 5A); H 54.50 mm, W 27.90 mm, H/D 1.95, N 6.125 and PA

18.42°; Paralectotypes: 2 sinistral (unfigured) and 1 dextral (Figure 5B).

Type Locality: determined by Rolle (1908) as forest at 4000 to 5000 ft. (1219 to 1524 m) altitude on Mt. Singgalang near Pandai Sikek, Sepuluh Koto District, Tanah Datar Regency, West Sumatra, Indonesia; colony extinct due to agricultural deforestation.

Other material examined: photos of 10 live adults (Figure 4 bottom snail); and 15 adult shells (JA, all dextral; Figures 5D, 6A, 6B, 6D & 7); 1 subadult shell (JP, dextral, protoconch missing; fig. 6A) — H 45.73 mm, D 24.63 mm, H/D 1.86, N 5.75, W 1.94 g and PA 23.10°; 1 adult (JP, dextral; Figure 6B) — H 51.31 mm, D 25.74 mm, H/D 1.99, N 6.50, W 4.90 g and PA 21.65°; and 1 shell claimed to be a "paratype" by Laidlaw and Solem (1961), CNHM 72436 (sinistral; Figure 5C).

Locality: broadleaf forest on Mt. Singgalang above Pandai Sikek.

Distribution: eastern flank of Mt. Singgalang above 1500 m altitude; probably found on other parts of Mt. Singgalang, and also on Mt. Tandikat at the same altitude since both volcanoes are connected (twin volcano), but not confirmed. (Figure 1)

Habitat: found on trunks, limbs and branches of tall trees in various types of forest.

Animal: mid-body and neck flesh-pink sprinkled with yellowish-orange granules more concentrated on the head, foot and tail; mid-dorsal stripe narrow to wide, pale to dark grey or black, continuing onto the face; optic tentacles yellowish-orange and sensory tentacles paler; mantle collar flesh pink and sole not seen.

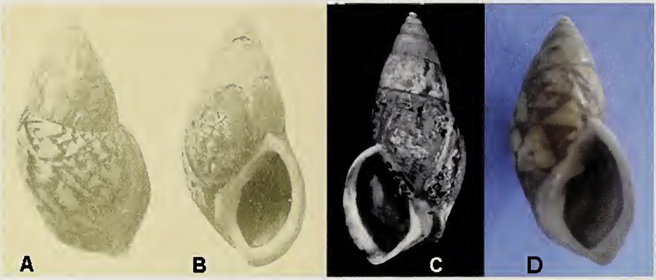


Figure 5. *A.* (*G.*) *b. bulowi* [not shown to the same scale]: **A**–**B** type shells figured by Fruhstorfer (1905; Taf. I, Fig. 2), **A** lectotype NHMUK 1910.12.30.98 and **B** paralectotype; **C** supposed "paratype" figured by Laidlaw and Solem (1961; fig. 37) CNHM 72436; and **D** shell showing a parietal ridge (JA).

Original Description (translated from Fruhstorfer, 1905)

Amphidromine shell of 7 flat whorls with a grey base colour, yellowish in younger specimens, whereupon broad black zigzag lines crisscross unsystematically. The lip edge is wide and of a white colour. The subgenus' characteristic angle at the aperture shows up on the last whorl in front as a strongly protuberant keel.

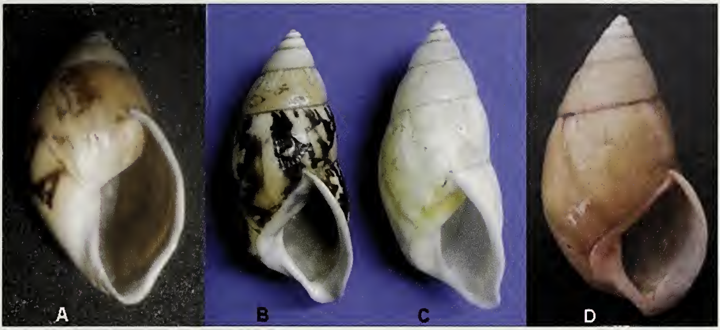


Figure 6. Comparison of the paries and overall coloration of both subspecies [not shown to the same scale]: **A–B** *A.* (*G.*) *b. bulowi* (JP), **A** subadult shell and **B** adult shell; **C** *A.* (*G.*) *b. malalakensis* n. ssp. (paratype 2 JP); and **(5) D** patternless *A.* (*G.*) *b. bulowi* (JA) [Photos: **A** & **D** by John Abbas; and **B** & **C** by Jeff Parsons].

Shell Variation

Original colony had a majority of sinistral shells (Figures 5A–C). However, recent finds have only been dextral (Figures 5D, 6A, 6B, 6D & 7A–C). Paries colour changes with that of the penultimate whorl, salmon-buff or liver-brown, which varies in intensity. Shells are rarely patternless (Figure 6D) and very rarely showing a brown super medial band on the early teleoconch whorls (Figure 7A). Pattern coloration varies: the network-forming markings are chestnut, chocolate, hazel or blackish brown and often partially cover random, paler secondary markings, which are chestnut, tawny or dark ochre patches or longitudinal streaks. Occasionally shells have small white blotches and/or white lines bordering the brown lines (Figures 4 bottom & 7C). Ground of the last whorl is usually cream-coloured, rarely salmon-buff or liver-brown.

Rostrum varies in extension and depth, sometimes hardly protruding and very shallow (Figure 5B). The bent base of the columella is shorter than the top part in only the subadult (Figure 6A) and longer in all adult shells studied. Rarely mature shells may develop a ridge at the base of the paries (Figure 5D) and often the margin of the parietal callus is thickened (Figures 5D & 6B) and joined to the columellar callus margin. The subadult (Figure 6A) has no umbilicus visible and proof of its presence in juveniles is unavailable. *Amphidromus* (*G.*) *b. bulowi* shows the same variation as *A.* (*G.*) *b. malalakensis* n. ssp. for the columella's root and in the shape of the shell and parieto-labral tubercle. Aperture is narrow to moderately wide and oblong (Figures 5D & 6B) or subtrapezoid (Figures 5B-C) at a ratio of 10:7. Back of the outer lip varies: 1) grey (as per its face); 2) dark brown (continuation of markings; fig. 4 bottom); or 3) coloured as per ground of the last whorl (Figures 7B–C).

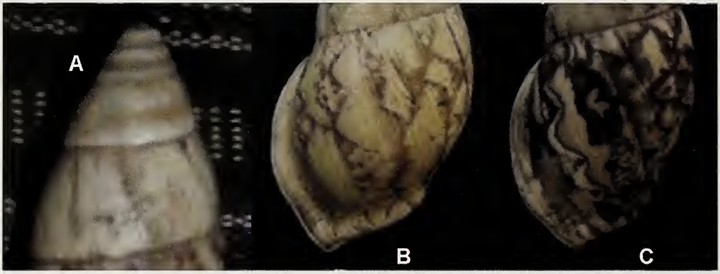


Figure 7. Coloration and pattern variation of *A.* (*G.*) *b. bulowi* (JA) **A** banded upper spire, **B** pale pattern elements and **C** dark pattern elements with some white borders [Photos by John Abbas].

DISCUSSION

The original population of *A.* (*G.*) *bulowi* was amphidromine and polymorphic. Volcanic activity from the twin volcano of Mt. Singgalang and Mt. Tandikat modified the soil, and hence the vegetation, on the residual hills and mounts of the western part of the Malalak valley. This valley is comprised of an andesitic rim of the Maninjau Caldera, Maninjau ignimbrite (c. 45000–55000 years old) covered with more recent tephra (ash deposits) from the twin volcano, which has part of its western flank also covered with tephra (Pribadi *et al.*, 2007). *Amphidromus* (*G.*) *b. malalakensis* n. ssp. represents 'disruptive selection' for individuals of one phenotype extreme that was better suited to a new ecological niche, such as that on Bukit Pandan, creating a habitat isolation event. This 'ecotype' formed a peripheral population on the boundary of a larger polymorphic population (parapatric distribution).

The snails' arboreal habit allowed dispersal across the valley, even occasionally across the rivers and creeks present, and interbreeding occurred in a contact zone. Cycles of volcanic activity from the twin volcano, separated the peripheral and main populations through destruction and modification of forest in the valley causing cyclic isolation and a peripatric distribution, thus establishing a 'peripheral subspecies'. Contact between the two populations was re-established during periods of volcanic quiescence through vegetation regrowth on new soil. Increased human settlement and agricultural deforestation over the last 60 years has broken the snails' dispersal paths across the valley, and mixing between the populations from Bukit Pandan and the twin volcano has ceased, creating an allopatric distribution.

Locals may not have collected sinistral specimens of *A.* (*G.*) *b. bulowi* due to shells being badly damaged, out of reach or simply absent where they have found live dextral snails. We are led to believe that they have only collected specimens on the eastern side of Mt. Singgalang, from forest above the locals' crops to the summit (Figure 1, blue dotted line). If true, this suggests that *A.* (*G.*) *b. bulowi* has no real preference for vegetation type, and so it should be found anywhere on Mt. Singgalang and Mt. Tandikat above 1500 m altitude (Figure 1, yellow dotted line).

Only slight differences in animal coloration occur between the two subspecies. Optic and sensory tentacles are the same tone in *A.* (*G.*) *b. malalakensis* n. ssp. versus *A.* (*G.*) *b. bulowi* with paler sensory tentacles. The tail of *A.* (*G.*) *b. malalakensis* n. ssp. and often its neck show more flesh-pink than does those of *A.* (*G.*) *b. bulowi*. The body granulation in *A.* (*G.*) *b. malalakensis* n. ssp. is yellowish-orange or reddish-orange, yellowish-orange in *A.* (*G.*) *b. bulowi*. The mid-dorsal stripe is grey in both subspecies and also blackish in *A.* (*G.*) *b. bulowi*.

The two subspecies are easily separated based on shell coloration. Shells of *A.* (*G.*) *b. malalakensis* n. ssp. are 'only dextral' and chalk-white with pale grey and/or light buff to tawny primary pattern of anastomose lines, occasionally with fleshy-ochre or tan longitudinal secondary markings; white outer lip, columella and interior; and a buff-yellow to cinnamon-buff paries. In contrast, shells of *A.* (*G.*) *b. bulowi* are 'rarely sinistral' and have a salmon-buff or liver-brown spire and usually cream-coloured last whorl, with dark brown to blackish brown markings; greyish-white to pale grey outer lip, columella and interior; the paries is the same colour as the penultimate whorl and the back of the lip is grey, dark brown or the same colour as the last whorl. Shells of *A.* (*G.*) *b. bulowi* with periostracum still intact have the last whorl ground colour looks darker or pale brownish tinted, in contrast that of *A.* (*G.*) *b. malalakensis* looks off-white (fig. 4). The adapertural deviation in the anterior part or base of the columella, aperture angle and the keel angle varied for both subspecies, however, not significantly between them. Other shell morphometric data did not show any significant differences between them worthy of further mention.

The predictions of melanin pigments present in shells of both subspecies have been tabulated (Table 1), and carotenoid-based red and yellow pigments are ignored. That data suggests the shell coloration of *A.* (*G.*) *b. malalakensis* n. ssp. is due to a basic lack of eumelanin, where small amounts form greyish primary markings and very small amounts create a greyish-white ground from the upper spire to the penultimate whorl. The white ground on the lower whorls is due to the absence of both eumelanin and phaeomelanin. By definition, these shells require a complete absence of both types of melanin to describe them as being albinistic (Hoekstra, 2006; van Grouw, 2012). Shells of *A.* (*G.*) *b. malalakensis* n. ssp. certainly have yellowish-brown markings and a brownish-yellow paries, most likely produced by phaeomelanin, so they are not albinistic shells. These shells are probably the result of a dilution gene, which causes an almost 100% reduction of eumelanin and leaves phaeomelanin unchanged, and best called "isabelline" shells (van Grouw, 2012).

A. (*G.*) *b. bulowi* is similar in shape to three Vietnamese species. *A.* (*G.*) *asper* Haas, 1934 has a larger shell with the same shell pattern, but has more convex whorls. The last whorl is very slightly flattened medially and subattenuated at the base, slightly compressed into a short rounded keel (holotype SMF 14428) or not (Figure 8A). The columella is vertical, straight to slightly twisted and sometimes bent briefly at its base toward the short spout; sub-truncate in juveniles. The aperture is oblong and subcaniculate at the base (holotype) or not (Figure 8A), passing into a short wide basal spout. *A.* (*G.*) *mirandus* (Bavay and Dautzenberg, 1912) (Figure 8B) has a similar sized shell to *A.* (*G.*) *b. bulowi*, but differs in being thinner, pure yellow with green-line periostracum and has a wider, more protruding spout. *A.* (*G.*) *thachi* Huber, 2015 (Figure 8C-D) is also amphidromine, but differs in being a smaller, patternless white shell with a black

ISSN 0738-9388

columella and black outer lip with a white border.

Current evidence suggests that *A.* (*G.*) *b. bulowi* is not present in western Malalak and continuation of agricultural deforestation will reduce the chance of such specimens being found there. Deforestation is worse on the eastern side of the valley, especially on Mt. Tandikat. The northern end of the valley is relatively untouched, but the physical connection between the rim of the Lake Maninjau caldera and Mt. Singgalang has been severed by a road cutting. It is possible that both subspecies occur on the caldera rim near the road cutting, and *A.* (*G.*) *b. bulowi* may also occur on Mt. Marapi. *A.* (*G.*) *b. malalakensis* n. ssp. will remain extremely rare unless new colonies can be found. *A.* (*G.*) *b. bulowi* will still be rarely collected due to the ruggedness of its range, continued deforestation at lower altitude and predators.

Feature	**outer lip, columella and interior**	**paries**	**back of outer lip**	**irregular, zigzag and/or branching lines**	**random longitudinal markings**
A. (*G.*) *b. bulowi*	greyish-white** to pale grey*	liver-brown or salmon-buff	as per last whorl or stained chestnut	chestnut, chocolate, hazel or blackish brown†	chestnut, tawny, dark ochre, or absent
predicted melanin pigments present	a trace** or small* amount of eumelanin	eumelanin and phaeomelanin	eumelanin and phaeomelanin	eumelanin and phaeomelanin or only eumelanin†	eumelanin and phaeomelanin
A. (*G.*) *b. malalakensis* n. ssp.	white	buff-yellow to cinnamon-buff	white	pale grey* and/or light buff to tawny	fleshy-ochre, tan or absent
predicted melanin pigments present	none	phaeomelanin	none	minor eumelanin* or phaeomelanin	phaeomelanin

Feature	**ground colour**			
	early whorls	**antepenultimate whorl**	**penultimate whorl**	**last whorl**
A. (*G.*) *b. bulowi*	chalk-white grading to greyish-white**	pale grey* becoming pale liver-brown or salmon-buff	liver-brown or salmon-buff ± cream-coloured patches	cream-coloured, rarely salmon-buff or liver-brown
predicted melanin pigments present	none to a trace amount of eumelanin**	increasing amounts of eumelanin plus phaeomelanin	eumelanin and phaeomelanin patchy minor phaeomelanin	minor phaeomelanin or eumelanin and phaeomelanin
A. (*G.*) *b. malalakensis* n. ssp.	as above	greyish-white**	greyish-white** and chalk-white patches	chalk-white
predicted melanin pigments present	as above	trace amount of eumelanin**	trace amount of eumelanin** or none	none

Table 1 Shell coloration comparison for both subspecies with predictions of melanin pigments present [Notes: pale grey* and greyish-white** are predicted to be the result of small/minor* and very small/trace** amounts of eumelanin].

ISSN 0738-9388

Figure 8. Nearest relatives of *A.* (*G.*) *bulowi* [shown at approximately the same scale]: **A** *A.* (*G.*) *asper* Daklak province, Vietnam (JP; H 59.54 mm); **B** *A.* (*G.*) *mirandus* syntype MNHN 2046 (H 48.5 mm; photo by P. Maestrati MNHN); and **C–D** *A.* (*G.*) *thachi* paratypes figured by Huber (2015; **C** fig. 4, H 33.3 mm & **D** fig. 5, H 29.6 mm).

ACKNOWLEDGEMENTS

We thank the following people: Jonathan Ablett, Curator (of Non-Marine Mollusca and Cephalopoda, Division of Invertebrates, Zoology Department) (NHMUK); and Virginie Héros, Chargée de conservation collection Mollusques (MNHN) for assistance in depositing type material and P. Maestrati (MNHN) for the photos of the *A.* (*G.*) *mirandus* syntype.

REFERENCES

Bülow, H., 1905. Einige Seltenheiten aus meiner Sammlung. Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft 37(1):78-83, Taf. 1, fig. 2.

Dharma, B., 2007. Report on fossil *Amphidromus* and description of new species and new subspecies of recent and fossil *Amphidromus* from Indonesia (Gastropoda, Pulmonata: Camaenidae). Schriften zur Malakozoologie 23:45-78.

Fruhstorfer, H., 1905. Ein neuer *Amphidromus*. Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft 37 (1):83-84, Taf. 1, fig. 2.

Haniel, C.B., 1921. Variationsstudie an timoresischen *Amphidromus* arten. Zeitschrift für Induktive Abstammungs- und Vererbungslehre 25 (Heft 1-2): pp. 1-88, (Mit 5 Tafeln, 27 Textfiguren, 5 Tabellen und einem Anhang mit den Schalenmaßen).

Hoekstra, H.E., 2006. Genetics, development and evolution of adaptive pigmentation in vertebrates. Heredity 97:222-234.

Huber, F., 2015. *Amphidromus thachi*, a new species (Gastropoda: Camaenidae) from Vietnam. Gloria Maris 54(1):29-31.

International Commission on Zoological Nomenclature (ICZN), 1999. International Code of Zoological Nomenclature, 4th edition. The International Trust for Zoological Nomenclature, London; 1-140. Available at: <http://www.bio-nica.info/biblioteca/ICZNCode.pdf8> [Accessed: 24 March 2013]

Laidlaw, F.F. and A. Solem, 1961. The land snail genus *Amphidromus*: a synoptic catalogue. Edited by LA Ross. Fieldiana: Zoology 41(4):505-677, 26 Text Figures; *Amphidromus* (*Goniodromus*) *bullowi* pp. 587 and 606, fig. 37.

Pribadi, A., Mulyadi, E. and I. Pratomo, 2007. Mekanisme erupsi ignimbrit Kaldera Maninjau, Sumatera Barat. Jurnal Geologi Indonesia 2(1):31-41.

Rolle, H., 1908. Zur Fauna von West-Sumatra. Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft 40(2):63-70; *Amphidromus* (*Goniodromus*) *bullowi* p. 67 (not illustrated).

University of Texas Libraries, 2014. Perry-Castañeda Library Map Collection, Indonesia AMS Topographic Maps, *Padang, Sumatra*, SA 47-3, Edition 1-AMS, East Indies 1:250,000, U.S. Army Map Service, 1954. txu-oclc-21752461-sa47-3.jpg. Available at: http://www.lib.utexas.edu/maps/ams/indonesia/txu-oclc-21752461-sa47-3.jpg [Accessed: 4 Mar 2014]

van Grouw, H., 2012. What colour is that Sparrow? A case study: colour aberrations in the House Sparrow *Passer domesticus*. International Studies on Sparrows 36:30-55.

ISSN 0738-9388

A new species of *Vasticardium* (Bivalvia: Cardiidae) from Queensland, Australia

Stephen J. Maxwell [1], Bradley C. Congdon [2] and Tasmin L. Rymer [2]

[1] College of Marine and Environmental Sciences, James Cook University, P.O. Box 6811, Cairns, Queensland 4870, Australia.stephen.maxwell@my.jcu.edu.au

[2] Centre for Tropical Environmental and Sustainability Studies, James Cook University, P.O. Box 6811, Cairns, Queensland 4870, Australia.

ABSTRACT A new species of *Vasticardium* from tropical Queensland, Australia, is described based on morphological differences with known taxa from that region. The new species differs in having acute ribs, a character it shares only with *Vasticardium angulata* Lamarck, 1819, which typically has coarser ribbing and which lacks colour within the shell interior.

INTRODUCTION

The family Cardiidae Lamarck, 1809, represents an ancient historical clade that can trace its linage back into the late Triassic (Schneider, 1995). Within the cardiums there have been significant contributions to the advancement and understanding of the taxonomy and diversity of the subclade *Trachycardiinae* Stewart, 1930 leading to a solid resolution of the complex as a whole within Cardiidae (Vidal, 1999; Coan and Valentich-Scott, 2012; Herrera *et al.*, 2015; Hylleberg, 2015; Schneider, 1992). The internal resolution of *Trachycardiinae* remains contentious. The *Vasticardium* and *Acrosterigma* have historically been combined and treated as synonyms (Lamprell and Whitehead, 1992; Wilson and Stevenson, 1977). *Vasticardium* has also been treated as a subgenus of *Acrosterigma* by some authors (Hylleberg, 1994). *Vasticardium* can be differentiated from *Acrosterigma* by the posterior and anterior being more distinctly sculptured than the dorsum and posteriorly notched as well as other structural characteristics, which may not be mutually exclusive (Vidal, 1999). Genetic evidence has current assigned *Vasticardium* forming a well nested exclusive clade apart from those assigned to *Acrosterigma*, while the cladistic resolution of the remaining *Trachycardiinae* is somewhat problematic (Herrera *et al.*, 2015). We treat here *Vasticardium* and *Acrosterigma* as distinct genera.

The new species is found in tropical Queensland, and is described as a morphological species. Comparative members of *Trachycardiinae* used in the description were restricted to *Vasticardium*. The list of comparative species was primarily guided by current distribution records and maximum size and general structure as presented in Lamprell and Whitehead (1992). Three primary characters were used in the determination of taxonomic difference: shape of the radial ribs; the interstices; and the colour of the interior. The radial ribs and interstices were described in terms of the cross-section of the mid-dorsal rib.

SYSTEMATICS

Class: Bivalvia
Subclass: Heterodonta
Order: Cardiidae

Superfamily: Cardioidea
Family: Cardiidae
Subfamily: Trachycardiinae
Genus: *Vasticardium* Iredale, 1927

Trachycardiinae Stewart, 1930

Shell asymmetrical with well-developed ribs over surface; ornamentation on the anterior and posterior divergent; cardinal teeth are unequal; posterior margin notched to digitate (Hylleberg, 1994).

Vasticardium Iredale, 1927

Shell higher than long; ribs variable with ornamentation on top of ribs may or not be present; posterior and anterior differing distinctly in sculpture to the rest of the dorsum; cardinals in right valve separated.

Vasticardium swanae Maxwell, Congdon & Rymer, 2016,
new species (Figures 1 and 2G)

Description: The moderately strong equivalved shell is ovate to quadrate; dorsum with 40-50 radial angulate smooth ribs; interstices with fine uniform arculate ridges that diminish becoming absent anteriorly, posteriorly increasing in size to the top of the ridges; anterior ribs with strong spines that dorsoventrally increase in size; ligament fine; anterior and posterior teeth fine and well developed; cardinal teeth unequal; margin straight, serrated and interlocking, becoming elongated at the anterior dorsal margin and diminishing on the posterior margin; lunacle concave and smooth; umbones white; dorsum with dark to light brown blotches and flecks, the larger of these are evidenced through the shell as a purple stain ventrally. (*see* Figure 1).

Type Material: Holotype measuring 45.8mm - Queensland Museum Registration (MO85748), collected by Beverly Swan.

Type Locality: Bramble Reef, off Lucinda, Queensland, Australia.

Distribution: This new species is known only from the type locality, Bramble Reef, off Lucinda, Queensland, Australia.

Ecology: This new *Vasticardium* species is found intertidally in sand.

Etymology: This new species is named in honour of Beverly Swan from Townville, Queensland, Australia, who discovered the specimens in the type lot. Ms. Swan is an avid amateur malacologist, an active shell collector, and member of the Townville Shell Club who has supported molluscan research for many decades.

Discussion: The new species has a distinctive shell that is rather colourful for a member of the larger *Vasticardium* (*see* Figure 2). The new species differs in rib morphology with *Vasticardium coralense* Vidal 1993, *V. elongata* Brugière, 1789, *V. luteomarginata* Voskuil & Onverwagt, 1991, *V. mendanaense* Sowerby, 1896 and *V. wilsoni* Voskuil & Onverwagt, 1991 which are non-angulate. *V. angulata* Lamarck 1819, is very similar to the new species as it has similar structural morphology of both ribs and interstices. *Vasticardium swanae* can be differentiated by its much coarser ribbing and the lack of colour in the aperture, which is typically found in *V. angulata*. Finally, *V. swanae* can be distinguished from *V. vertebrata* Jonas, 1844 by the lack of rib coarseness and the colour blotches in the aperture.

Figure 1. Holotype of *Vasticardium swanae*, n sp., collected by Beverly Swan on Bramble Reef, off Lucinda, Queensland, 45.8 mm.

As indicated above, *Vasticardium* and *Acrosterigma* have been treated as synonyms in the past, and a comparison should be made to a similar looking *Acrosterigma* species. While having structural differences peculiar to their differing genera, *Acrosterigma variegata* Sowerby, 1841 shows some similarities to the new species (*see* Vidal, 1999). The *A. variegata* syntype differs from *Vasticardium swanae* in having a curved margin and shell which is distinctly more ovate (Vidal, 1999; *see* Figure 3). Additionally, the new species lacks the tinged yellow internal margin of *A. variegata*. It is highly probable that many collections may contain specimens of *V. swanae* labeled under the name *A. variegata* due to the above stated superficial similarities in size and internal colouration.

ACKNOWLEDGEMENTS

The authors thank Valda Cantamessa for allowing them access to her extensive and wonderfully curated collection, for providing comparative material, and for donating the holotype which has been deposited in the Queensland Museum. The authors thank the reviewers for providing invaluable comments to facilitate the timely publication of this paper. We also thank Trevor and Marguerite Young for photographic logistics and offering helpful comments on the manuscript without which this paper would not have been possible.

REFERENCES

Coan, E.V. & P. Valentich-Scott 2012. Bivalve Seashells of Tropical West America: Marine Bivalve Mollusks from Baja California to Northern Perú. Santa Barbara Museum of Natural History Monographs Number 6: Studies in Biodiversity Number 4, Santa Barbara Museum of Natural History, Santa Barbara. 764 pp.

Herrera, N.D., J.J. ter Poorten, R. Bieler, P.M. Mikkelsen, E.E. Strong, D. Jablonski, & S.J. Steppan. 2015. Molecular phylogenetics and historical biogeography amid shifting continents in the cockles and giant clams (Bivalvia: Cardiidae). Molecular Phylogenetics and Evolution 93:94-106.

Hylleberg, J. 1994. Indo-Pacific cockles (Bivalvia: Cardiidae) part 1: Generic diagnoses and an overview of species with

mention of taxonomic problems encountered in Thailand. Phuket Marine Biological Centre Special Publication 13: 113-136.

Hylleberg, J. 2015. Revision and morphometric characteristics of the *Vasticardium fidele* group (Bivalvia: Cardiidae) in the Indo-Pacific with description of three new species. Novapex 16:81-94.

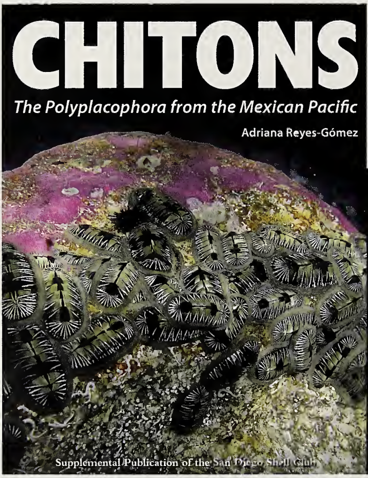
Lamprell, K. & Whitehead, T. 1992. Bivalves Australia: Volume 1. Crawford House Press, Bathurst. 182 pp.

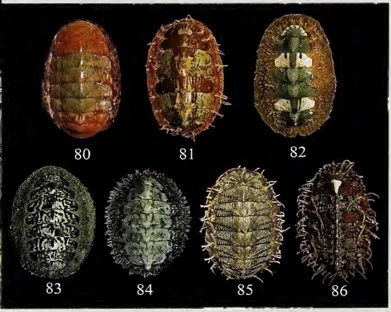
Schneider, J.A, 1992. Preliminary cladistics analysis of the bivalve family Cardiidae. American Malacological Bulletin 9:145-155.

Schneider, J.A. 1995. Phylogeny of the Cardiidae (Mollusca, Bivalvia): Protocardiinae, Laevicardiinae, Lahullinae, Turlonogocardiinae subfam. n. and Pleuriocardiinae subfam. n.. Zoologica Scripta 24: 321-346.

Vidal, J. 1999. Taxonomic review of the elongated cockles: genera *Trachycardium*, *Vasticardium* and *Acrosterigma* (Mollusca, Cardiidae). *Zoosystema* 21: 259-335.

Wilson, B.R. & S. Stevenson. 1977. Cardiidae (Mollusca, Bivalvia) of Western Australia. Western Australian Museum Special Publication no. 9. 114 pp.





ISSN 0738-9388

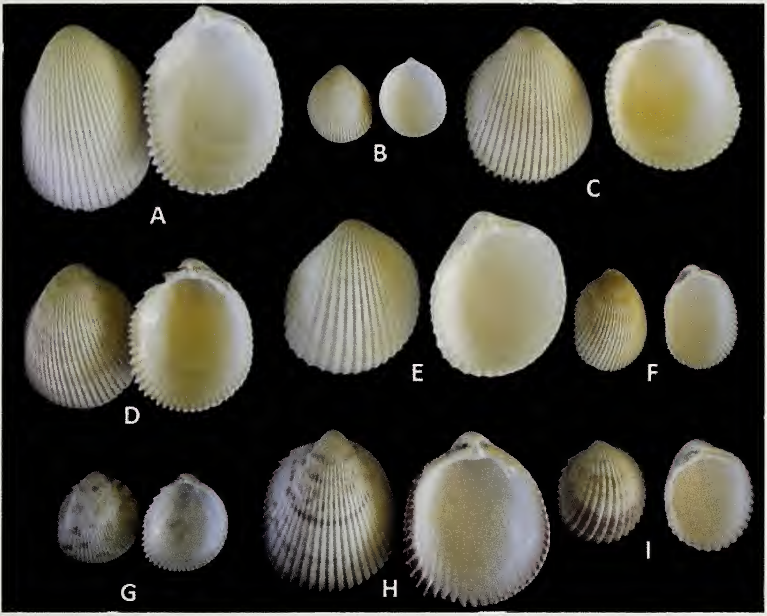


Figure 2. The new species with comparatives showing size and morphology: **A** = *Vasticardium wilsoni* Voskuil & Onverwagt, 1991: Broome 89.7 mm Cantamessa collection; **B** = *Acrosterigma impolita* Sowerby 1833: Queens Beach, Bowen 38.8 mm Cantamessa Collection note the lack of posterior and anterior shell distinctiveness from the dorsum that is atypical in the sister *Vasticardium*; **C** = *V. luteomarginata* Voskuil & Onverwagt, 1991: Solomon Islands 75.9 mm Cantamessa Collection; **D** = *V. elongata* Brugière, 1789: Bramble Reef 71.4 mm Cantamessa Collection; **E** = *V. angulata* Lamarck 1819: Swains Reefs 75.6 mm Cantamessa Collection; **F** = *V. coralense* Vidal 1993: Swains Reefs 51.3 mm Cantamessa Collection; **G** = *V. swanae* new species: Bramble Reef 45.8 mm, Holotype: Queensland Museum Type No. MO85748.; **H** = *V. mendanaense* Sowerby, 1896: Swains Reefs 80.1 mm Cantamessa Collection; **I** = *V. vertebrata* Jonas, 1844: Myora Beach 51.6 mm Cantamessa Collection.

ISSN 0738-9388

Camaena chuongi, a new species (Gastropda: Camaenidae) from Vietnam

Nguyen Ngoc Thach
Former Research Associate, Nha Trang Oceanographic Institute
kurodashvietnam@yahoo.com

ABSTRACT A new species of genus *Camaena* Albers, 1850 is described from Tân Lạc, Hòa Bình, Vietnam and compared to two other species and a form of this genus: *Camaena gabriellae* Dautzenberg & d'hammonville, 1887, *Camaena hainenensis* (H. Adams, 1870) and *Camaena gabriellae* f. *subhainenensis* (Pilsbry, 1890). It is characterized by slightly flat base and very few spiral bands (only one band at periphery and another band along suture of each whorl) on pure white background color.

KEYWORDS Gastropoda, Helicoidea, Camaenidae, *Camaena*, Tân Lạc, Hòa Bình, Vietnam, new taxon.

INTRODUCTION: The genus *Camaena* Albers, 1850 belongs to the family Camaenidae and has many species collected in Vietnam. In February 2016, a hitherto unknown camaenid was found. It was not listed in the works by Parkinson, Hemmen & Groh (1987), Abbott (1989), Dharma (2005), Stanisic, Shea, Potter & Griffiths (2010), Schileyko (2011) or Thach (2005, 2007, 2012, 2016). It is here described as new to science.

Abbreviations:

- ANSP Academy of Natural Sciences of Drexel University, Philadelphia, USA
- MNHN Muséum National d'Histoire Naturelle, Paris, France
- NNT Collection Dr. Thach
- AW Aperture Width
- SH Shell Height
- SW Shell Width

SYSTEMATICS:

Class Gastropda Cuvier, 1797
Superfamily Helicoidea Rafinesque, 1815
Family Camaenidae Pilsbry, 1895
Genus *Camaena* Albers, 1850
Type species: ***Helix cicatricosa*** Müller, 1774, subsequent designation by Martens in Albers, 1860

Camaena chuongi n. sp.
Figures 1-8

Description:

Shell medium-sized for the genus (34.8-40.4 mm in average adult width) conic-heliciform, wider than high with shell height 79.6% of shell width (*see* Table 1 with measurements on seven specimens). Spire tall, sutures adpressed. Body whorl moderately inflated, periphery with a narrow spiral band. Sculpture consisting of numerous fine closely-spaced axial riblets becoming stronger when approaching body whorl. Aperture semicircular with width 54.1% of shell width (*see* Table 1), outer lip thin, slightly reflected. Base slightly flat and weakly sculptured, umbilicus deep and open but partly covered by reflected columella. Color pure white with dark brown spiral band at periphery and along suture of each whorl.

Table 1. Mean SH/SW and AW/SW of *Camaena chuongi* n.sp.

Specimen:	SW (mm)	SH (mm)	SH/SW	Mean SH/SW	AW (mm)	AW/SW	Mean AW/SW
1	36.6	28.2	0.77	0.796	19.0	0.52	0.541
2	37.8	31.0	0.82		19.0	0.50	
3	34.8	29.7	0.85		18.3	0.53	
4	40.1	33.4	0.83		22.5	0.56	
5	35.7	28.5	0.79		21.0	0.59	
6	34.0	25.6	0.75		18.0	0.53	
7	40.4	30.8	0.76		22.7	0.56	

Type material: Holotype 36.6 mm wide in ANSP (Figures 1, 2b). Paratypes: all from type locality, Paratype 1: 37.8 mm wide in MNHN (Figure 3); Paratype 2: 34.8 mm wide in NNT (Figure 2a, 4b); Paratype 3: 40.1 mm wide in NNT (Figure 4a, 7) and Paratype 6: 40.4 mm (Figure 6) in NNT; and Paratypes 4 at 35.7 mm and 5 at 34.0 mm (not illustrated).

Type locality: Tân Lạc District, Hòa Bình Province, Vietnam.

Habitat: The type specimens were collected around trees.

Etymology: The new species is named in honor of Mr. Nguyễn Ngọc Chương, the author's brother for his help in this scientific study.

DISCUSSION:

- *Camaena chuongi* n.sp. is close to *Camaena gabriella* f. *subhainenensis* (Pilsbry, 1890) (Fig. 11b, 12) but differing in less inflated whorls, flatter base, less numerous spiral bands, white umbilical area and white background color.

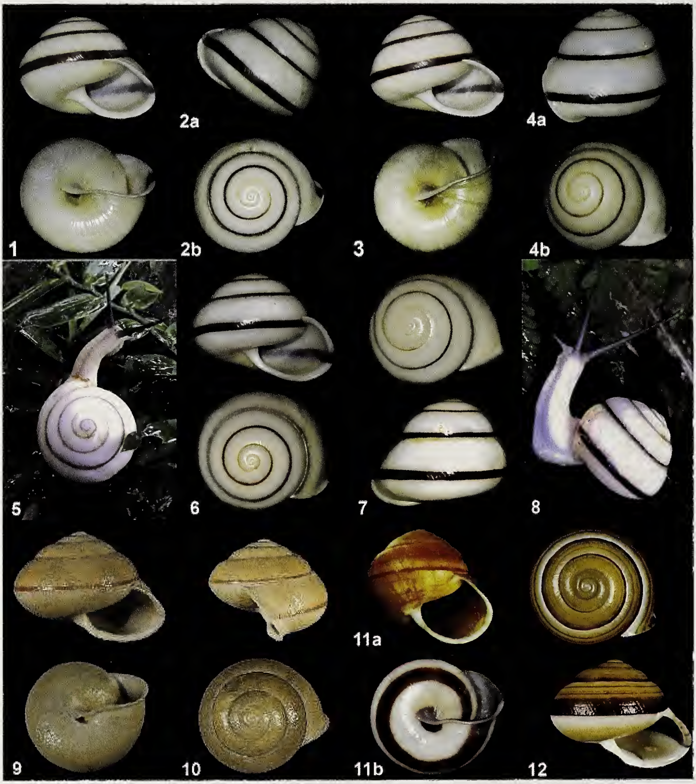
- *Camaena gabriella* Dautzenberg & d'hammonville, 1887 (Figures 9,10) differs mainly from *Camaena chuongi* in having a more inflated base and the absence of a pure white background color.

- *Camaena hainenensis* (H.Adams, 1870) (Figure 11a) differs mainly from *Camaena chuongi* in very swollen body whorl, much wider aperture, numerous spiral bands and the absence of a white background color.

ACKNOWLEDGEMENTS:

Thanks to the Paris Museum of Natural History for the photo of *Camaena gabriella*, and Guido Poppe and Philippe Poppe for photos of comparative specimens of *Camaena gabriella* f. *subhainenensis*. Thanks are also extended to the reviewers for useful comments.

ISSN 0738-9388



Figures 1-8: ***Camaena chuongi*** n.sp., Hòa Bình, Vietnam- **1, 2b**: Holotype 36.6 mm, ANSP- **2a**: Paratype 2: 34.8 mm wide, NNT- **3**: Paratype 1, 37.8 mm wide, MNHN- **4a**: Paratype 3, 40.1 mm wide, NNT- **4b**: Paratype 2, NNT- **5**: Live animal- **6**: Paratype 6, 40.4 mm- **7**: Paratype 3- **8**: Live animal- **9,10**: ***Camaena gabriellae*** Dautzenberg & d'hammonville, 1887, photo of Paris Museum of Natural History for comparison- **11a**: ***Camaena hainenensis*** (H.Adams, 1870) 40 mm, photo of T. Abbott, 1989 for comparison- **11b**: ***Camaena gabriella*** f. ***subhainenensis*** (Pilsbry, 1890) 34.2 mm for comparison- **12**: ***Camaena gabriella*** f. ***subhainenensis*** 36.9 mm, photo of P. & G. Poppe, 2014 for comparison.

ISSN 0738-9388

REFERENCES:

Abbott, R.T. 1989. Compendium of landshells. American Malacologists Inc., Florida, USA, 240pp.

Dharma, B. 2005. Recent & Fossil Shells of Indonesia. ConchBooks, Hackenheim, Germany, 432pp.

Parkinson, B., J. Hemmen & K. Groh. 1987. Tropical land shells of the world. Verlag Christa Hemmen, Wiesbaden, Germany, 279 pp.

Schileyko, A.A. 2011. Check-list of land pulmonate molluscs of Vietnam (Gastropoda: Stylommatophora). Ruthenica, Russia, Vol.21, No 1, 68 pp.

Stanisic, J., M. Shea, D. Potter, & O. Griffiths. 2010. Australian Land Snails, Volume 1. Bioculture Press, Mauritius, 591pp.

Thach, N.N. 2005. Shells of Vietnam. ConchBooks, Hackenheim, Germany, 430pp (including 92 color plates).

Thach, N.N. 2007. Recently Collected Shells of Vietnam. L'Informatore Piceno & NNT, Ancona, Italy, 380pp (inlcuding 118 color plates).

Thach, N.N. 2012. New Records of Molluscs from Vietnam. 48HrBooks Co., USA, 427pp (including 151 color plates).

Thach, N.N. 2016. Vietnamese New Mollusks. 48HrBooks Co., USA, 205pp (including 99 color plates).

Website of Museum of Natural History, Paris, France.

Website of Philippe & Guido Poppe (Conchology, Inc.)

ISSN 0738-9388

Six New Species of Gastropods (Fasciolariidae, Conidae, and Conilithidae) from Brazil

Edward J. Petuch [1] and David P. Berschauer [2]
[1] Department of Geosciences, Florida Atlantic University, Boca Raton, Florida 33431
epetuch@fau.edu
[2] 25461 Barents Street, Laguna Hills, California 92653
shellcollection@hotmail.com

ABSTRACT Six new gastropods, belonging to the families Fasciolariidae, Conidae, and Conilithidae, recently have been discovered within the biogeographical boundaries of the Brazilian Molluscan Province. These include: *Poremskiconus fonsecai* n. sp. and *Poremskiconus smoesi* n. sp. (both Conidae) from the Cearaian Subprovince of northern Brazil; *Jaspidiconus josei* n. sp. (Conilithidae) from the Bahian Subprovince of central Brazil; and *Fusinus damasoi* n. sp., *Fusinus mariaodeteae* n. sp. (both Fasciolariidae), and *Lamniconus petestimpsoni* n. sp. (Conidae) from the Paulinian Subprovince of southern Brazil.

KEY WORDS Fasciolariidae, Conidae, Conilithidae, Brazil, *Fusinus*, *Poremskiconus*, *Lamniconus*, *Jaspidiconus*, Brazilian Molluscan Province, Cearaian Subprovince, Bahian Subprovince, Paulinian Subprovince.

INTRODUCTION

Over the past ten years, extensive exploration and collecting along the coasts of Brazil have yielded many new and interesting malacological discoveries (some outlined in Petuch, 2013; Petuch and Myers, 2014; and Petuch and Sargent, 2011). Of the Brazilian coastal regions, three areas and ecosystems remain the least-studied: the coralline algal rhodolith bioherms systems off Maranhao, Piaui, and Ceara States (within the Cearaian Subprovince of northern Brazil); the coral reef systems on the Abrolhos Platform off southern Bahia State (within the Bahian Subprovince of central Brazil); and the wide continental shelf off Sao Paulo, Parana, Santa Catarina, and Rio Grande do Sul States (within the Paulinian Subprovince of southern Brazil). Preliminary ecological research conducted in these three areas has revealed that the biodiversity was much higher than previously thought (Petuch, 2013) and that high levels of endemism, particularly in the gastropod mollusks, occurred on several of the dominant biotopes.

Working with the local fishermen, the intrepid Brazilian/Portuguese collector, Damaso Monteiro, and the Brazilian collectors and well known shell dealers, Marcus and Jose Coltro, have been able to accumulate a large number of new gastropod taxa from these previously-unexplored areas. All of these new species live in deeper water areas offshore and can only be collected by dredging and trawling or by examining the contents of deep water crab and lobster traps. Through the generous donation of suites of new species by Sr. Monteiro and the Coltro brothers, we have been able to describe six of these new Brazilian taxa, including three new species of Conidae, one new species of Conilithidae, and two new species of Fasciolariidae. These additions to the biodiversity of the marine faunas of Brazil are

described in the following sections. The holotypes of the new species are deposited in the molluscan collections of the Zoological Museum of the University of Sao Paulo, Sao Paulo, Brazil and bear MZSP numbers.

SYSTEMATICS

Class Gastropoda
Subclass Sorbeoconcha
Order Prosobranchia
Infraorder Neogastropoda
Superfamily Conoidea
Family Conidae
Subfamily Puncticulinae
Genus *Lamniconus* da Motta, 1991

Lamniconus petestimpsoni Petuch and Berschauer, new species
(Figures 1E, F, G & H)

Description: Shell of average size for genus, narrow, elongated, with straight or slightly concave sides; spire proportionally low, with early whorls subpyramidal; juvenile specimens (like individual shown on Figure 1G and 1H) have higher, more elevated spires than do adult specimens, and spire gradually flattens out as individual matures; shoulder sharply-angled, edged with low, broad, rounded carina, producing slightly concave spire whorls; body whorl smooth and glossy, with matte finish and silky texture; anterior end encircled with 12-14 evenly-spaced, low, rounded spiral cords; shell color typically bright reddish-orange, overlaid with one or two wide white or pinkish-white bands, one around mid-body and one anterior of shoulder area; red and white bands overlaid with 18-20 narrow rows of evenly-spaced alternating dark brown and white rectangular spots; spire whorls white or pale orange-white, overlaid with large, evenly-spaced orange-brown crescent-shaped flammules that connect to large dark brown spots and patches along shoulder carina; some specimens (rarely seen) have the same general color pattern as holotype, but have deep yellow bands instead of typical bright red-orange bands; aperture white or pale violet-white, proportionally narrow, widening toward anterior end; protoconch proportionally large, orange in color, rounded, domelike, composed of 2 whorls.

Type Material: HOLOTYPE- length 46.5 mm, width 23.5 mm, from off Cabo Frio, Rio de Janeiro State, MZSP 131405 (Figure 1E, F); **PARATYPE-** length 25.1 mm, width 11.0 mm, from same locality as the holotype, LACM 3377 (Department of Malacology, Los Angeles County Museum of Natural History, Los Angeles, California; Figure 1G, H); **Other Study Material-** length 51.0 mm, same locality as the holotype, in the research collection of the senior author; length 49.9 mm (yellow color form), same locality as the holotype, in the research collection of the junior author.

Type Locality: Trawled by commercial shrimp boats from 100 m depth, east of Santana Island, Rio de Janeiro State, Brazil.

Distribution: At present, known only from the area extending from Cabo Frio to Rio de Janeiro and the offshore islands of Rio de Janeiro State, Brazil.

Ecology: The new species lives on an organic-rich muddy sand substrate in depths of 80-120 m. Here it lives in association with extensive scallop beds of *Lindapecten tehuelchus* and abundant peneid shrimp.

Etymology: The new Brazilian species is named for Peter G. Stimpson, M.D., of Tennessee; an avid amateur naturalist and malacologist. His friend, Marcus Coltro, kindly donated the type lot so that the new taxon could be named in his honor.

Discussion: Of the eight known species of the southern Brazilian endemic genus *Lamniconus*, *L. petestimpsoni* is most similar to *L. lemniscatus* (Reeve, 1849) (Figure 1A, B). The new species differs from *L. lemniscatus* in being a more cylindrically-shaped shell with a less tapering outline, in consistently having a proportionally higher spire, and in being a much more colorful shell, with a much brighter color pattern composed of intense red-orange bands and very numerous rows of dark brown rectangular spots. The rows of dots on the drabber brown and white *L. lemniscatus* are fewer in number and more widely separated and are proportionally smaller. *Lamniconus petestimpsoni* is also similar to *L. xanthocinctus* (Petuch, 1980) (Figure 1C, D), also from the Cabo Frio region, but differs in being a more cylindrical shell, in having a proportionally lower spire, and in having a different color pattern, composed of wide red bands and numerous dark brown dots and lacking the deep yellow-orange or golden yellow color and poorly-developed spots of its congener (*see* Petuch and Myers, 2014 for an overview of the genus *Lamniconus*).

Genus *Poremskiconus* Petuch, 2013

Poremskiconus fonsecai Petuch and Berschauer, new species
(Figures 2E, F, G & H)

Description: Shell small for genus, turbinate, wide across shoulder, tapering abruptly to anterior end; shoulder sharply angled, edged with blade-like carina; edge of carina slightly overhangs body whorl; spire elevated, broadly pyramidal, with slightly stepped whorls; body whorl smooth and shiny, sculptured with 10-12 large rounded cords that encircle anterior one-half; body whorl colored solid pale orange (as in holotype), pink, or greenish-yellow, marked with wide band of amorphous white flammules around mid-body; spire white, marked with widely-scattered radiating flammules, varying in color from pale orange (as in holotype), pinkish-tan, or olive green; protoconch pinkish-orange, proportionally small and acuminate, composed of 2 whorls; aperture narrow, straight, white within interior.

Type Material: HOLOTYPE- length 16.6 mm, width 8.6 mm, from off Rio do Fogo, Rio Grande do Norte State, Brazil, MZSP 131313 (Figure 2E & F); **Other Study Material**- length 14 mm, width 7 mm, same locality as the holotype, in the research collection of the senior author; length 12.8 mm, width 6.6 mm, same locality as the holotype, in the research collection of the junior author (Figure 2G & H); length 15.0 mm, width 8.0 mm, same locality as the holotype, in the Thierry Vulliet Collection, Arundel, Queensland, Australia.

Type Locality: Collected under slabs of coralline algae, in 10 m depth off Rio do Fogo, Rio Grande do Norte State, Brazil.

Distribution: *Poremskiconus fonsecai* ranges from Camocim, Ceara State to Rio do Fogo, Rio Grande do Norte State, but may extend westward to Maranhao State.

Ecology: The new species prefers shallow water carbonate sediment environments, preferably 10-20 m depths, where it lives in association with coralline algal rhodolith concretions.

Etymology: Named for Dr. Francisco Fonseca da Silva, of Lisbon, Portugal, a specialist in the Conidae, who, together with Damaso Monteiro, has conducted extensive research along northeastern Brazil.

Discussion: Of the three known *Poremskiconus* species from northern Brazil, *P. fonsecai* most closely resembles *P. mauricioi* (J. Coltro, 2004),

but differs in being a much smaller and less inflated shell, in having a simple color pattern that lacks any brown flammules or patches, and in having a much more sculptured shell, being encircled with large, prominent spiral cords. This sculptural pattern of strong spiral cords on the anterior one-half of the body whorl is seen only on the new species and on its southern congener, *P. abrolhosensis* (Petuch, 1987) from the Abrolhos Archipelago of Bahia State, Brazil.

Poremskiconus smoesi Petuch and Berschauer, new species
(Figures 2I, J, K & L)

Description: Shell of average size for genus, stocky, truncated, with inflated body whorl; shoulder sharply angled, subcarinate; spire elevated, subpyramidal, with scalariform stepped whorls; body whorl smooth and shiny, sculptured with 8-10 thin, low spiral threads around anterior end; body whorl color white or pale pinkish-white, overlaid with numerous large, amorphous angular brown or reddish-brown flammules, arranged in zebra or zig-zag pattern; zebra flammules interrupted by white mid-body band, which bisects them into two sections; zebra flammules are not solidly-colored, but are composed of darker tan or orange-colored, extremely fine, closely-packed longitudinal lines superimposed upon paler tan or orange base color; spire whorls white, marked with widely-spaced dark orange-brown crescent-shaped flammules; edge of spire flammules intersect with zig-zag flammules of body whorl; early whorls orange; protoconch proportionally large, domed, orange in color, composed of 2 whorls; aperture narrow, white within interior.

Type Material: HOLOTYPE- length19.9 mm, width 11.1 mm, from off Camocim, Ceara State, Brazil, MZSP 131314 (Figure 2I & J); **Other Study Material**- length 20.0 mm, width 6.0 mm, same locality as the holotype, in the research collection of the senior author; length 19.1 mm, width 10.7 mm, same locality as the holotype, in the research collection of the junior author (Figure 2K & L).

Type Locality: Taken in crab traps, from 20 m depth on coralline algal nodule (rhodolith) sea floor, off Camocim, Ceara State, Brazil.

Distribution: The new species is known only from the areas offshore of Camocim, Ceara State, Brazil, but may also occur on the offshore Canopus Banks.

Ecology: The new species prefers coralline algal nodule substrates in 20-30 m depths.

Etymology: Named for Dr. Frederic Smoes of Brussels, Belgium, a great admirer of the Conidae and a specialist in conid biodiversity.

Discussion: In size and general shape, *Poremskiconus smoesi* most closely resembles the northern Brazilian *P. mauricioi*, but differs in having straighter, less convex sides, in having a proportionally higher spire with distinctly stepped whorls, and in having a completely different type of color pattern. In *P. mauricioi*, the body whorl is a solid red, orange, yellow, tan, or khaki green color, overlaid with scattered amorphous patches of white and rows of pale brown dashes and dots. In *P. smoesi*, the body whorl is white or pink, overlaid with large tan or orange zig-zag flammules and completely lacks the spiral rows of dashes and dots. Instead, the interiors of the flammules on the new species are composed of closely-packed brown hairlines arranged in a zebra-like pattern. No other species of *Poremskiconus* is known to have this type of longitudinal striping within individual flammules.

ISSN 0738-9388

Family Conilithidae
Subfamily Conilithinae
Genus *Jaspidiconus* Petuch, 2003

Jaspidiconus josei Petuch and Berschauer, new species
(Figures 2A, B, C & D)

Description: Shell of average size for genus, stocky, barrel-shaped, inflated, with slightly convex sides; shoulder sharply-angled, bordered by low, rounded carina; spire elevated, broad and subpyramidal, with slightly stepped whorls; body whorl shiny and polished, encircled with 12-15 deeply-incised spiral sulci around anterior one-half to two-thirds; base body whorl color variable, ranging from pale lavender (most common color), pale blue, pink, or pale tan; base color overlaid with widely-separated pale brown longitudinal flammules and 20-25 spiral rows of closely-packed tiny white dots; spire white with widely scattered radiating brown flammules, which often connect with large brown longitudinal flammules on body whorl; both suture and edge of carina marked with prominent small dark brown spots; aperture proportionally wide and flaring, becoming wider toward anterior end; interior of aperture purple-brown; protoconch pale brown, proportionally large and mammilate, composed of 2 whorls.

Type Material: HOLOTYPE- length 20.1 mm, width 10.7 mm, from off Itapoan, Bahia State, Brazil, MZSP 131315 (Figure 2A & B); **Other Study Material-** length 22.0 mm, width 11.0 mm, from same locality as the holotype, in the research collection of the senior author; length 20.7 mm, width 11.0 mm, same locality as the holotype, in the research collection of the junior author (Figure 2C & D).

Type Locality: In carbonate sand and brown algae, 3 m depth off Itapoan, Bahia State, Brazil.

Distribution: The new species is confined to central Bahia State, Brazil, primarily from the shallow beach areas near Itapoan and north of Salvador.

Ecology: *Jaspidiconus josei* prefers open carbonate sand areas, often with abundant *Dictyota* brown algae, in depths of 2-5m.

Etymology: Named for Jose Coltro, of Sao Paulo, Brazil and Miami, Florida, noted authority on the Conidae and Conilithidae of Brazil.

Discussion: Of the known Bahian *Jaspidiconus* species, *J. josei* is most similar to *J. marinae* Petuch and Myers, 2014 in general shell color and color pattern and in having an elevated spire. The new species differs from the Itaparica Island endemic *J. marinae* in being a larger and much more inflated shell with distinctly rounded sides, in having a row of tiny dots around the spire suture, and in having smaller and more numerous dots along the edge of the shoulder carina. *Jaspidiconus josei* is also similar, in both shell color and size, to *J. simonei* Petuch and Myers, 2014 from farther south, in Espirito Santo and Rio de Janeiro States, but differs in being a much more inflated and barrel-shaped shell with rounded sides and in having a row of tiny brown dots around the suture. The new species has often been misidentified as, or confused with, "*Conus mindanus* Hwass, 1792)" by several workers and shell dealers, but that species is a much larger and more brightly-colored shell that is confined to the Carolinian and Caribbean Molluscan Provinces and does not occur in the Brazilian Molluscan Province (*see* Berschauer, 2015; Petuch, 2013; Petuch and Myers, 2014; and Poremski, 2014 for details on the *Jaspidiconus mindanus* species complex).

Superfamily Buccinoidea
Family Fasciolariidae
Subfamily Fusininae
Genus *Fusinus* Rafinesque, 1815

Fusinus damasoi Petuch and Berschauer, new species
(Figures 3A, B, C & D)

Description: Shell of average size for genus, heavy and thickened, fusiform, with elevated, scalariform spire; body whorl inflated, with sharply-angled shoulder; subsutural areas sloping; shoulder ornamented with 10-12 large, prominent, rounded knobs; shoulder knobs sometimes well-developed and sharply-pointed; body whorl coarsely-sculptured with 18-20 large raised spiral cords; siphonal canal proportionally short, truncated, broad, ornamented with 12-14 large, coarse spiral cords; body whorl-siphonal canal juncture indented, abrupt; shell color cream white or pale whitish-tan, overlaid with extremely numerous, closely-packed, amorphous dark brown longitudinal flammules, arranged in zebra pattern; some shoulder knobs colored dark brown; aperture white, oval in shape, flaring, sculptured with 14-16 large spiral cords; protoconch proportionally large, bulbous, colored orange-tan, and composed of 2 whorls.

Type Material: HOLOTYPE- length 69.5 mm, width 28.9 mm, from 45 m off Arraial do Cabo, Rio de Janeiro State, Brazil, MZSP 131311 (Figure 3A & B); **Other Material Studied-** length 68.0 mm, width 29.0 mm, from the same locality as the holotype, in the research collection of the senior author; length 59.4 mm, width 24.7 mm, same locality as the holotype, in the research collection of the junior author (Figure 3C & D).

Type Locality: Dredged from 45 m depth, by commercial shrimpers, off Arraial do Cabo, Cabo Frio region, Rio de Janeiro State, Brazil.

Distribution: At present, known only from offshore areas (40-60 m depths) of the Cabo Frio region of northern Rio de Janeiro State. The new species may occur in deep water areas off southern Rio de Janeiro State and Sao Paulo State.

Ecology: *Fusinus damasoi* prefers organic-rich muddy sand sea floors in the deeper waters off the upwelling systems that occur along Cabo Frio. Here, it occurs along with immense scallop beds of *Lindapecten tehuelchus*.

Etymology: Named for Damaso Monteiro of Ceara State, Brazil and Portugal, renowned diver and malacological explorer, who collected the type lot while working with the local fishermen at Cabo Frio.

Discussion: Up to now, only five species of the genus *Fusinus* have been described from the Brazilian coastline. These include: *F. brasiliensis* (Grabau, 1904), which ranges from Ceara State to Espirito Santo State; *F. marmoratus* (Philippi, 1851), which ranges from Sergipe State to Espirito Santo State; *F. strigatus* (Philippi, 1851), which ranges from Sergipe State to southern Bahia State; *F. frenguelli* (Carcelles, 1953), which ranges from Rio de Janeiro State to northern Argentina; and *F. agatha* (Simone and Abbate, 2005), which ranges from Rio Grande do Norte State to Sergipe State. Of these, *F. damasoi* is most similar to *F. brasiliensis*, but differs in being a smaller shell with a more inflated body whorl and more rounded shoulder, in having a proportionally lower and less-exerted spire, in having finer and more numerous spiral cords around the body whorl, and in having a proportionally much shorter and broader

siphonal canal. Although similar in color and color pattern, the broader, stumpier shell form and distinctly shorter siphonal canal immediately differentiates the Cabo Frio *F. damasoi* from the more northern, wide-ranging *F. brasiliensis*.

Fusinus mariaodeteae Petuch and Berschauer, new species
(Figures 3E, F, G & H)

Description: Shell small for genus, thin, delicate, elongated, distinctly fusiform; shoulder completely rounded, with no angulation; body whorl inflated, with rounded sides, ornamented with 12 large, rounded, evenly-spaced spiral cords; faint, thin spiral thread present between each pair of spiral cords; body and spire whorl spiral cords, in turn, overlaid with 13-16 narrow, low, evenly-spaced longitudinal ribs; intersection of spiral cord and longitudinal rib producing low, elongated bead; spire and siphonal canal of approximately same length; siphonal canal straight, sculptured with 18-20 fine, smooth spiral ribs; siphonal canal-body whorl juncture abrupt, highly indented, constricted; body whorl and siphonal canal uniformly pale cream or pale straw color, with interstices between ribs sometimes being slightly darker colored; spire and early whorls darker yellow-cream to pale orange; aperture almost round, pale cream-white within interior, sculptured with 12-14 large ribs; prototconch pale yellow-orange, proportionally very large, bulbous and mammilate, composed of 2 whorls.

Type Material: HOLOTYPE- length 43.2 mm, width 16.3 mm, from 100 m depth off Santos, Sao Paulo State, Brazil, MZSP 131312 (Figure 3E & F); **Other Material Studied**- length 37.0 mm, width 14.0 mm, same locality as holotype, in the research collection of the senior author; length 40.9 mm, width 14.9 mm, same locality as the holotype, in the research collection of the junior author (Figure 3G & H).

Type Locality: Trawled by fishermen from 100 m depth off Santos, Sao Paulo State, Brazil.

Distribution: At present, only known from the deeper water areas off the Sao Paulo State coast, Brazil, but may extend southward to off Rio Grande do Sul State.

Ecology: *Fusinus mariaodeteae* prefers clean sand sea floors, in depths of around 100 m, where it occurs with beds of the scallop *Lindapecten tehuelchus* and large numbers of echinoids and peneid shrimp.

Etymology: Named for Mariaodete Monteiro of Portugal, mother of Damaso Monteiro.

Discussion: Of the known Brazilian *Fusinus* species, *F. mariaodeteae* is similar only to *F. frenguelli*. Both species have very rounded shoulders and a sculpture pattern of intersecting strong spiral cords and narrow longitudinal ribs and both are colored a pale cream-white of pale yellow. The new Sao Paulo species differs, however, in being a much smaller, stockier, and less elongated species with a proportionately lower spire and much shorter siphonal canal. The spiral cords on *F. frenguelli* are also much larger and more pronounced, and have more numerous smaller cords and threads between each set of main ribs. The larger *F. frenguelli* also prefers shallow water, normally being collected in 20-50 m depths, while *F. mariaodeteae* is a more offshore animal, preferring depths of 100-150 m.

ACKNOWLEDGMENTS

The authors thank their Brazilian friends, Srs. Damaso Monteiro, Marcus Coltro, and Jose

Coltro, for the generous donation of specimens of the new species.

REFERENCES

Berschauer, D.P. 2015. A comparison of adaptive radiation in Conidae and Conilithidae (Gastropoda: Conoidea) in the Eastern and Western Atlantic, together with an iconography of the conilithid genus *Jaspidiconus*. The Festivus 47(2):99-113.

Petuch, E.J. 2013. Biogeography and Biodiversity of Western Atlantic Mollusks. CRC Press. New York, London, Boca Raton. 234 pp.

Petuch, E.J. and R.F. Myers. 2014. New Species of Conidae and Conilithidae (Gastropoda: Conoidea) from the Bahamas, Eastern Caribbean, and Brazil. Xenophora Taxonomy 3:26-46.

Petuch, E.J. and D.M. Sargent. 2011. New Species of Conidae and Conilithidae (Gastropoda) from the Tropical Americas and Philippines, with Notes on some poorly-known Floridian Species. Visaya 3(3):37-58.

Poremski, A. 2014. Disentangling the Hidden Biodiversity of the Genus *Jaspidiconus*. The Festivus 45(4):126-128.

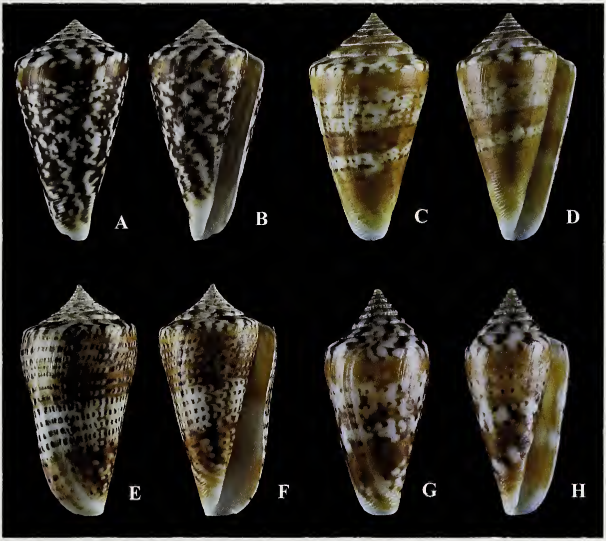


Figure 1. A new *Lamniconus* species from Brazil. Images: A, B = *Lamniconus lemniscatus* (Reeve, 1849) 44.9 mm in length. **C, D** = *L. xanthocinctus* (Petuch, 1980) 41.5 mm in length. **E, F** = *L. petestimpsoni* new species. Holotype, MZSP 131405, length 46.5 mm. **G, H** = *L. petestimpsoni* new species. Paratype, LACM 3377, length 25.1 mm.

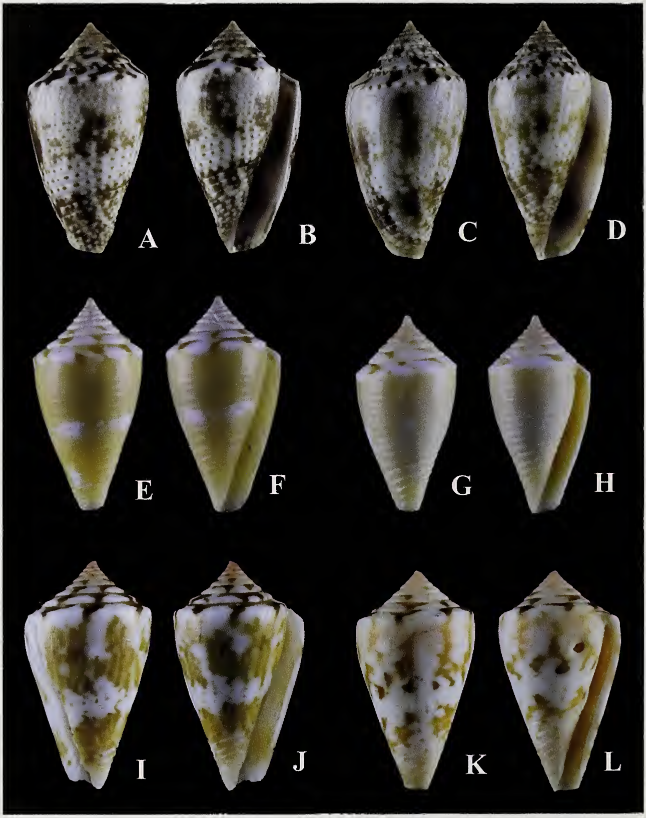


Figure 2. New *Poremskiconus* and *Jaspidiconus* species from Brazil. Images: A, B = *Jaspidiconus josei* new species. Holotype, MZSP 131315, length 20.1 mm. C, D = *J. josei* new species, length 20.7 mm in the Berschauer Collection. E, F = *Poremskiconus fonsecai* new species. Holotype, MZSP 131313, length 16.6 mm. G, H = *P. fonsecai* new species, length 12.8 mm in the Berschauer Collection. I, J = *P. smoesi* new species. Holotype, MZSP 131314, length 19.9 mm. K, L = *P. smoesi* new species, length 19.1 mm in the Berschauer Collection.

ISSN 0738-9388

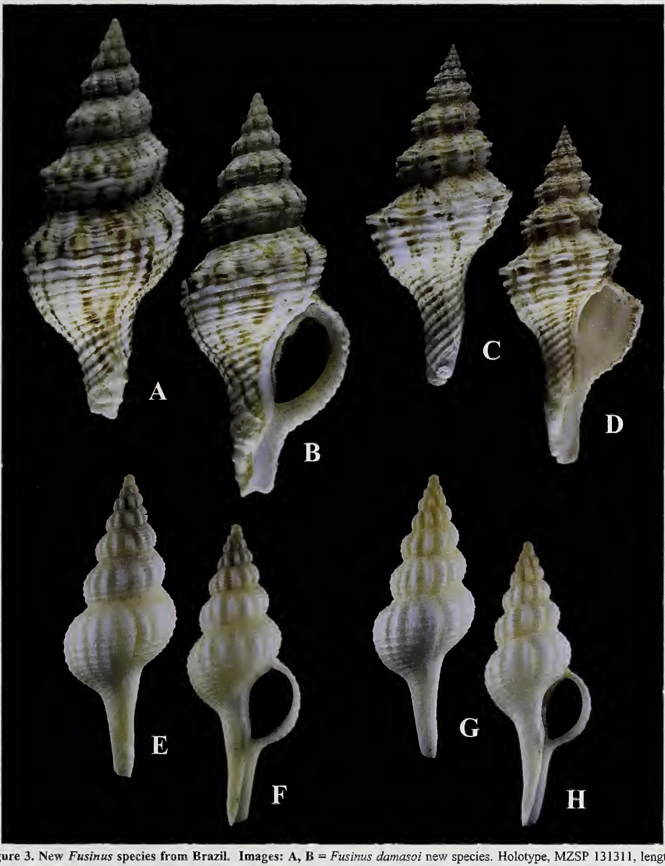


Figure 3. New *Fusinus* species from Brazil. Images: A, B = *Fusinus damasoi* new species. Holotype, MZSP 131311, length 69.5 mm. C, D = *F. damasoi* new species, length 59.4 mm in the Berschauer Collection. E, F = *F. mariaodeteae* new species. Holotype, MZSP 131312, length 43.2 mm. G, H = *F. mariaodeteae* new species, length 40.9 mm in the Berschauer Collection.

ISSN 0738-9388

An iconography of the Western Indian endemic abalone *Haliotis unilateralis* Lamarck, 1822 (Vetigastropoda: Haliotidae) with notes on its taxonomic history, distribution, ecology, and evolution

Buzz Owen [1] and Aaron D. Pan [2]
[1] P.O. Box 601, Gualala, CA 95445 buzabman@mcn.org
[2] Don Harrington Discovery Center, 1200 Streit Drive, Amarillo, TX 79106 apan@dhdc.org

ABSTRACT The rare West Indian Ocean endemic abalone *Haliotis unilateralis* is not well known and is often misidentified with the congeneric species *Haliotis rugosa pustulata* Reeve, 1846. Here we provide a photographic survey of the species from several populations throughout its distribution range to assist with identification.

KEY WORDS Abalone, *Haliotis*, Red Sea, reef, taxonomy.

INTRODUCTION

Haliotis unilateralis is a small-sized abalone species that is endemic to the Western Indian Ocean. Although the species is relatively rare, its distribution is widespread in the region, being found in the Red Sea, the northwestern Arabian Sea (Oman), the Gulf of Oman (United Arab Emirates), along portions of East Africa coastline (including Tanzania, Mozambique, and northernmost South Africa), southern Madagascar, the Seychelles, and the Mascarenes (Geiger & Owen, 2012; Owen, 2007; Owen *et al.*, 2016; Figure 1). This review is to provide addition information of the species including a comprehensive iconography of the taxon along with information about its ecology, fossil record, evolution, and taxonomic history. Additionally, plates are provided to highlight congeneric *Haliotis* taxa from the Western Indian Ocean and to provide visual assistance identifying and making determinations between *Haliotis unilateralis* and some specimens of *Haliotis rugosa pustulata*, which have been confused with the former species.

Abbreviation of collections: BOC: Buzz Owen Collection, Gualala, CA, USA; FFC: Franck Frydman Collection, Paris, France; RRC: Robert Kershaw Collection, Narooma, NSW, Australia; ARC: Arjay Raffety Collection, Marina del Rey, CA, USA; MHNG: Muséum d'Historie Naturalle, Geneva, Switzerland; NGC: Norbert Göbl Collection, Gerasdorf, Austria; MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA; WRC: Wilco Regter Collection, Gateshead, UK; BGC: Bavius Gras Collection, Leeuwarden, The Netherlands; KSC: Katherine Stewart Collection, (in Cal Adacemy of Sciences "CASIZ", San Francisco, CA, USA); TGC: Tom Grace Collection, USA. All shells in BOC unless otherwise indicated.

Materials and Methods: Shell specimens were cleaned and photographed with a Canon A650ES digital camera. Images were processed in Adobe Photoshop 6 and placed on black plates.

Shells examined: *Haliois unilateralis*, Red Sea area (Egypt and Israel), >50; northern Mozambique (Nacala), 28; southern

Mozambique (Ponta Techobanine; Inhaca Island) to S. Africa, 6; Mauritius, 24; Brandon Atoll, 22; Mirbut, Oman, 1; Fujairah, United Arab Emirates, 1; Bassas de India, 1. *Haliotis rugosa pustulata*, Northern Mozambique, 19. *Haliotis barbouri* (synonym of *H. unilateralis*). Holotype (unique).

Ecology: A subtidal to sublittoral (to at least 60 m depth) species, occurring in coral reef communities, particularly under coral rubble, coral heads, and reef ledges (Geiger, 1996; Zuschin *et al.*, 2009; Geiger & Owen, 2012).

Fossil Record, Evolution, and Biogeography: Pleistocene fossils purportedly representing *Haliotis unilateralis* are reported from coral reef deposits from Sudan and Zanzibar Island (Tanzania; Newton, 1900; Hall & Standen, 1907; Geiger & Groves, 1999; Geiger & Owen, 2012). While the paleoenvironment and geographic location of these fossils is congruent with the species, it is possible that this fossil material may actually represent *Haliotis rugosa pustulata* according to Geiger & Groves (1999).

Phylogenetic relationships between *Haliotis unilateralis* and other species in the family are not known (Geiger & Owen, 2012). No molecular phylogenetic studies have included samples of *Haliotis unilateralis* (Geiger & Owen, 2012). However, based on its location in the Western Indian Ocean, this species likely belongs to one of two clades within the family, the *Haliotis tuberculata* species group (*i.e. Haliotis rugosa, H. tuberculata, H. marmorata*) or the Indo-Pacific *Haliotis* species group (*i.e. Haliotis clathrata, H. ovina, H. varia*). In either case, future studies on the phylogenetic relationships within the Haliotidae should include the uncommon *H. unilateralis*.

Many specimens of *Haliotis unilateralis* from the Red Sea appear to represent a distinctive morphotype. Mature shells of Red Sea specimens are typically larger, possess a more rounded shelf-like ridge between the columella and respiratory holes, and often have smoother texture compared to specimens found outside of this geographic area. In addition, specimens from localities outside of the Red Sea often have shell coloration patterns that include strong flammules, proscocline rays, and are brighter than Red Sea specimens, which are often more subdued in coloration. One possible explanation of this different phenotype may be Pleistocene isolation between populations in the Red Sea and those found in the Indian Ocean. During this period, water exchange between these two marine bodies was limited at the Strait of Bab al Mandab (DiBattista *et al.,* 2016). Fluctuations in sea level in the Red Sea, particularly near the Strait of Bab al Mandab may have hindered mixing between populations of gastropods in northern Red Sea and the rest of the Western Indian Ocean populations (DiBattista *et al.,* 2016).

Taxonomic History: Little was known about this species until two papers, Geiger 1991 and Geiger 1996 were published. Geiger (1991; 1996) noted that the original holotype specimen of *Haliotis unilateralis*, located in the Muséum d'Historie Naturalie de Geneva (MHNG), did not match the original description by Lamarck, and actually represented a specimen of *Haliotis varia* Linnaeus, 1758. Geiger (1996) corrected this error by assigning a neotype of *H. unilateralis.* Images of the former holotype and neotype are illustrated in Figure 1.

In addition, *Haliotis unilateralis* is likely the correct identity of the taxon *Haliotis barbouri* Foster, 1946 (Figure 7). A single specimen of what was considered to be an unknown species of *Haliotis* was found by J. Modesto dos Santos at Praia de Copacabana, Brazil in the early 1940s and was named in Foster (1946) as

Haliotis barbouri. However, no additional specimens of this taxon have been found in the Western Atlantic or Brazil. In 2005, the first author examined the holotype and was able to determine that the specimen was comparable to specimens of *Haliotis unilateralis* from Mozambique (Nacala). However, it is still not known how a *Haliotis unilateralis* shell from Mozambique arrived on a beach in Brazil, although a connection of both countries being former Portugese colonies and increased recreational and business travel during the early to mid-20th century at least provides some plausible explanations.

ACKNOWLEDGEMENTS

We thank Franck Frydman, Bavius Gras, Wilco Regter, Norbert Göbl, and the late Bob Kershaw for providing images of shell specimens from their collections. We also thank Adam Baldinger of MCZ for making the specimen of *H. barbouri* available for photography in 2005.

REFERENCES

DiBattista, D.J., J.H. Choat, M.R. Gaither, J.P.A. Hobbs, D.F. Lozano-Cortés, R.F. Myers, G. Paulay, L.A. Rocha, R.J. Toonen, M.W. Westneat, & M.L. Berumen. 2016. On the origin of endemic species in the Red Sea. Journal of Biogeography 43:13-30.

Foster, R.W. 1946. The family Haliotidae in the western Atlantic. Johnsonia 2:36-40.

Geiger, D.L. 1991. A third species of *Haliotis* in the Red Sea. Probably a curious form of *Haliotis ovina* Gmelin, 1791. Gloria Maris: 29 (6):95-103.

Geiger, D.L. 1996. Haliotids in the Red Sea, with neotype designation for *Haliotis unilateralis* Lamarck, 1822 (Gastropoda: Prosobranchia). Revue Suisse de Zoologie 103:339-354.

Geiger, D.L. 1998. Recent genera and species of the family Haliotidae Rafinesque, 1815 Gastropoda: Vetigastropoda). The Nautilus 111:85-116.

Geiger, D.L. 2000. Distribution and biogeography of the Recent Haliotidae (Gastropoda: Vetigastropoda) world-wide. Bollettino Malacologico 35:57-120.

Geiger, D.L. & L.T. Groves. 1999. Review of fossil abalone (Gastropoda: Vetigastropoda: Haliotidae) with comparison to recent species. Journal of Paleontology 73:872-885.

Geiger, D.L. & B. Owen. 2012. Abalone Worldwide Haliotidae. Conchbooks, Hackenheim, 361 pp., 92 pls.

Hall, W.J. & R. Standen. 1907. On the Mollusca of a raised coral reef on the Red Sea coast. Journal of Conchology 12:65-68.

Lamarck, J.B. 1822. Historie Naturelle des Animaux sans Vertebres. Vol. 6 (2):1-232.

Newton, R.B. 1900. Pleistocene shells from the raised beach deposits of the Red Sea. Geological Magazine, London 7:500-514, 544-560.

Owen, B. 2007. A photo study and brief description of the little known abalone: *Haliotis unilateralis* Lamarck, 1822, and designation of *H. barbouri* Foster, 1946, as a junior synonym. Of Sea and Shore 27:229-235, 237.

Owen B., W. Regter, & K. Van Laethem. 2016. A review of the *Haliotis* of Yemen and Oman with description of a new species, *Haliotis arabiensis*, from Oman and United Arab Emirates. The Festivus 48:84-92.

Zuschin, M., Janssen, R. & C. Baal. 2009. Gastropods and their habitats from the northern Red Sea (Egypt: Safaga), Part 1: Patellogastropoda, Vetigastropoda and Cycloneritimorpha. Ann. Naturhist. Mus. Wien 111A:73-158.

ISSN 0738-9388

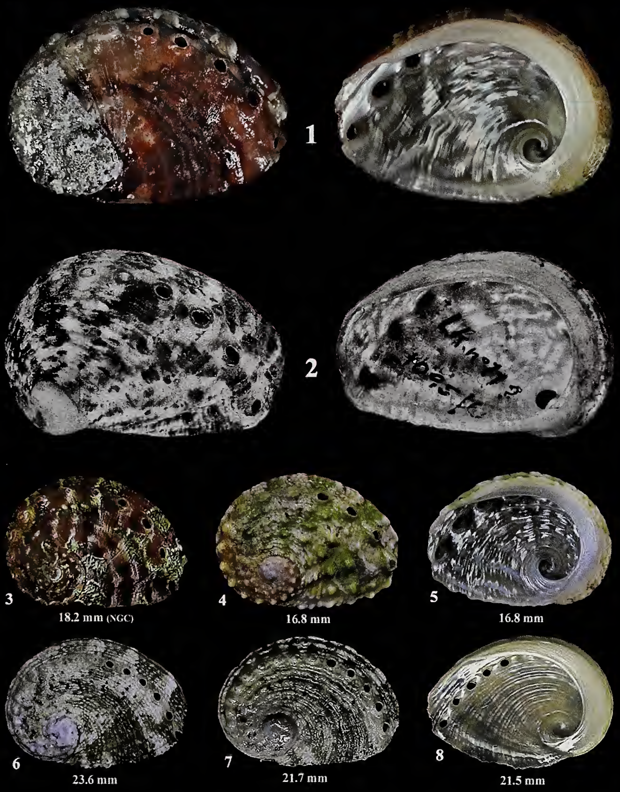


FIGURE 1. 1. *Haliotis unilateralis* Lamarck, 1822. Neotype selected by Daniel Geiger (1996). 33.8 mm. 2. Holotype in Lamarck collection (specimen of *H. varia* - see text). 35.5 mm. 3-5. Southern Mozambique to South African Border. 6-8. *Haliotis rugosa pustulata* Reeve, 1846. Nacala, Mozambique.

ISSN 0738-9388

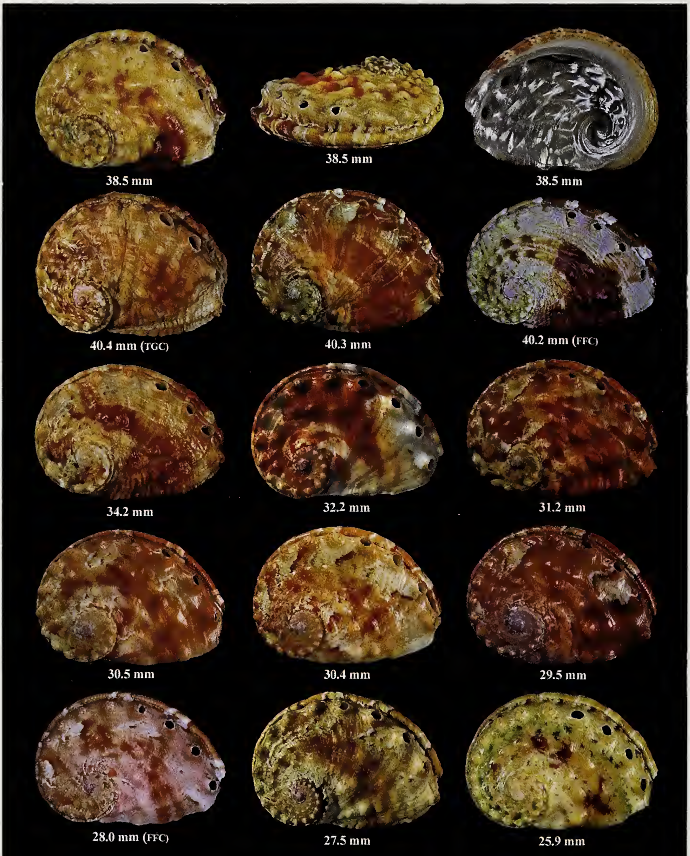


FIGURE 2. *Haliotis unilateralis* Lamarck, 1822. Gulf of Aqaba, Sinai, Egypt, to Eilat, Israel, Red Sea.

ISSN 0738-9388

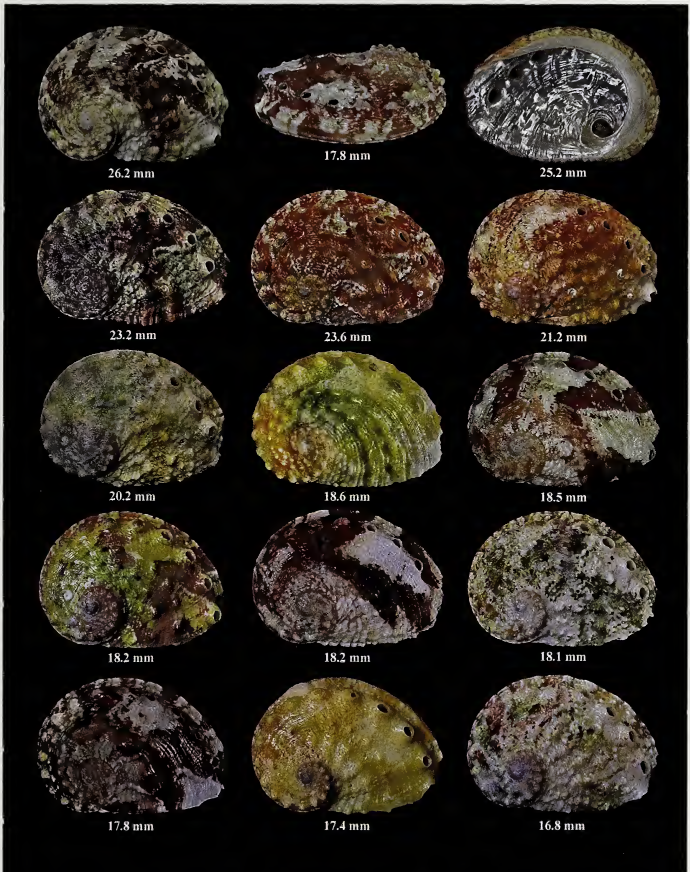


FIGURE 3. *Haliotis unilateralis* Lamarck, 1822. Nacala Bay, Fernão Veloso, Mozambique.

ISSN 0738-9388

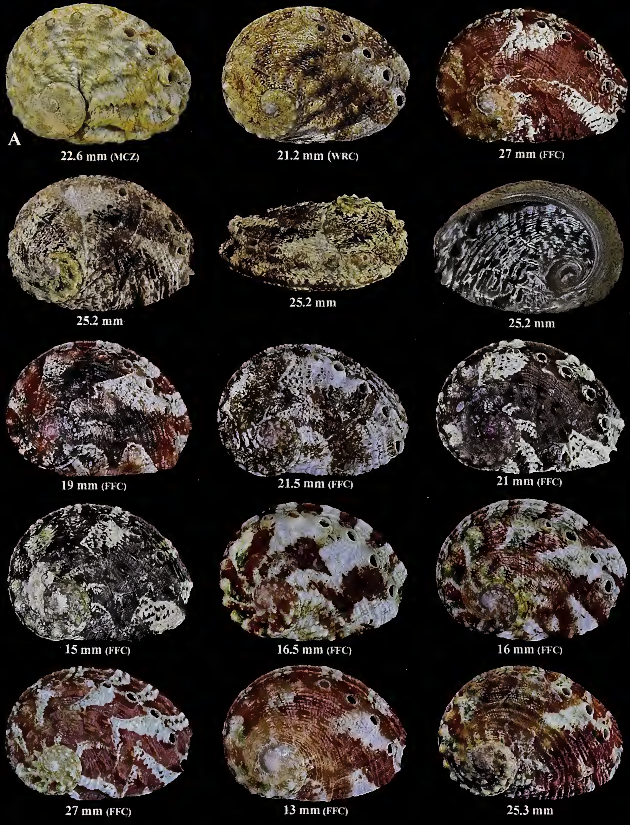


FIGURE 4. A - *Haliotis barbouri* Foster, 1946 (junior synonym for *H. unilateralis* Lamarck, 1822. Found on Copacabana Beach, Rio de Janeiro, Brazil). All others, *H. unilateralis*. Mauritius. Only data.

ISSN 0738-9388

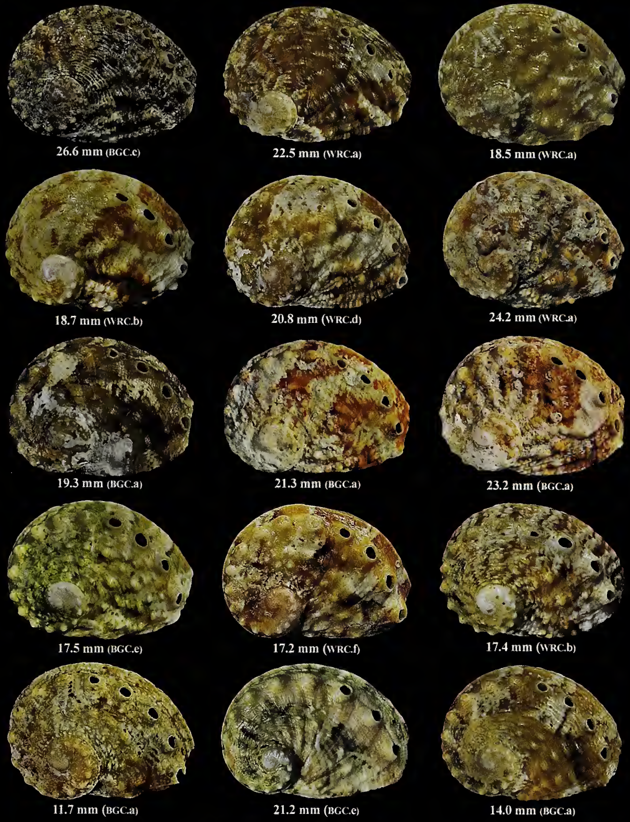


FIGURE 5. *Haliotis unilateralis* Lamarck, 1822. Mauritius. (a= Flacq district, Plage de Palmar; b= Flacq district, Ile Marianne; c= Riviere Rempart district, Péreybere; d= Savanne district, St-Felix). Red Sea. (e= Eilat, Israel; f= Egypt, Gulf of Aqaba, Dahab Bay). All collected by WRC & BGC as noted.

ISSN 0738-9388

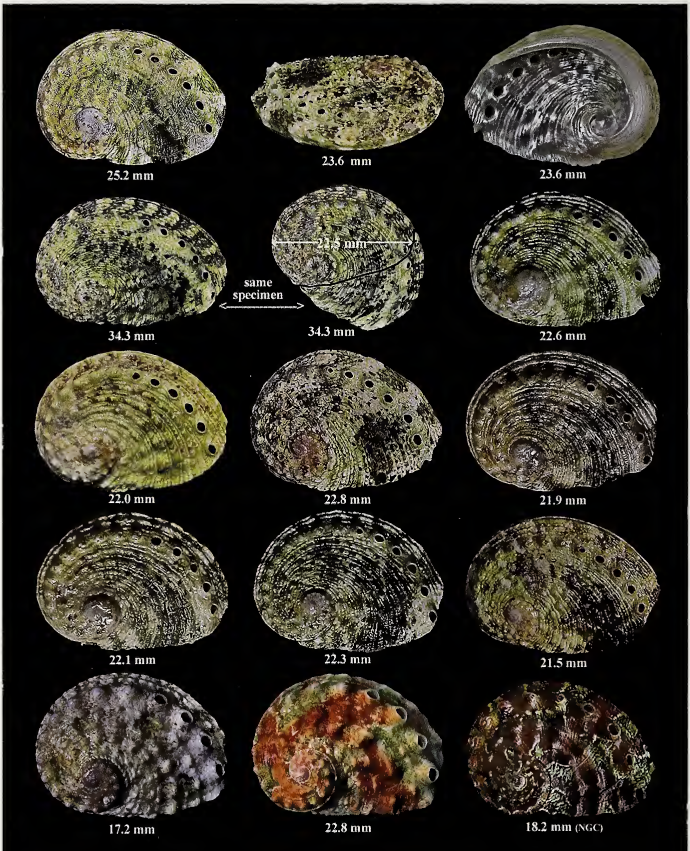


FIGURE 6. Top Four Rows: *Haliotis rugosa pustulata.* Fernão Veloso area, North Mozambique. Bottom Row: *H. unilateralis.* Inhaca Is., South Mozambique. All specimens live-taken in 10-15 m.

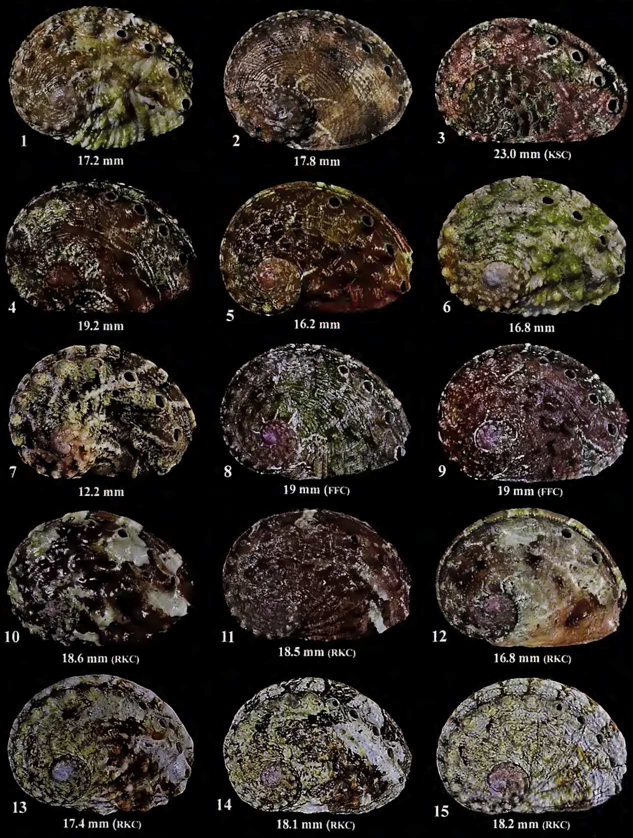


FIGURE 7. *Haliotis unilateralis* Lamarck, 1822. 1. N. Fujairah, United Arab Emirates. 2. Mauritius. 3. Bassas da India. 4-9. Ponta Techobanine to Inhaca Island, South Mozambique. 10-15. St. Brandon's Atoll.

ISSN 0738-9388

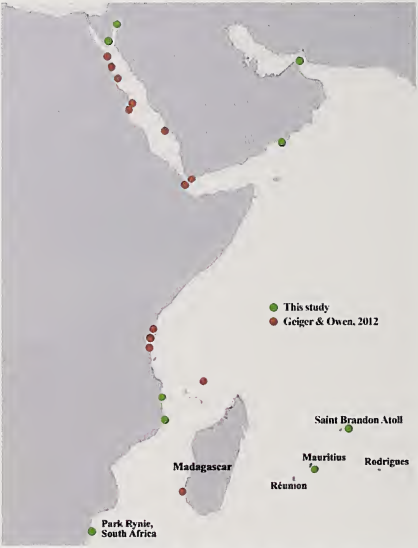


Figure 8. Map illustrating distribution of *H. unilateralis* this study and additional sites listed in Geiger & Owen, 2012

ISSN 0738-9388

Have a shell collection you would like to donate or devise?

The San Diego Shell Club is interested in high quality estate shell collections. As a 501c(3) organization, all donations to our Club may provide a tax write-off. When we receive a donation we carefully record each item and provide a letter describing the items that may be used when filing your taxes. While we cannot provide a value, donations of up to $5,000 do not require a written appraisal. Since tax laws change regularly we recommend that you check with your tax accountant before relying on any information provided in this paragraph. We are interested in all types of shells, marine or land and all genera and species, books on shells as well as items related to shells such as artwork, storage cases and tools. Your items will be used to generate income to support the Club's efforts in continuing Public education about shells and conservation of marine life throughout the world. If you would like to donate, please contact Dave Waller, SDSC Acquisition Chairperson, at dwaller@dbwipmg.com to schedule a time to discuss charitable gifting.

CLUB NEWS

August 18, 2016, Regular Meeting, Balboa Park Room 104
- Meeting called to order at 7:40 p.m.
- Treasurer's report was given
- Editors report was given
- Shells and books were displayed and shells were offered for sale via silent auction
- Speaker Dave Waller gave a presentation on organizing, storing and caring for a collection.
- David Berschauer gave the "5 minute" presentation on how to clean a shell.
- Meeting adjourned at 9:10 p.m.

September 24, 2016 - End of Summer Party: In lieu of regular meeting, at Larry and Debbie Catarius' house, 4173 Galt Street, San Diego, California 92117.

October 15, 2016, Regular Meeting, 751 Raintree Drive, Carlsbad, CA
- Meeting called to order at 12:15 p.m.
- Pizza and soda were provided
- Shells and books were displayed and shells were offered for sale via silent auction
- Speaker Julian Lee gave a presentation on various forms of *Neobernaya spadicea*
- Lisa Dawn Lindahl gave the "5 minute" presentation on *Cymbium glans* (Elephant's Snout).
- Meeting adjourned at 2:00 p.m.

ISSN 0738-9388

You Can't Take Them with You

David B. Waller
505 N. Willowspring Dr., Encinitas, California 92024
dwaller@dbwipmg.com

In my previous articles over the past year, I have given some insight into my investigations in the best way to divest myself of my collections. There are many options. My first article "Uncle Dave left me what?" discussed the option of gifting my collection to a museum or dispersing them to family and friends, my second article "The Collector's Catch-22" focused on donating portions of my collection while I'm living to obtain the tax benefits and in my third article "Dad, There Just Shells" I discussed my idea of teaching my family about my collection so that they can sell the shells when I'm gone. In this, my last article, I discuss what may be the perfect solution; gifting my collection to a shell club.

If you are like me and none of your family is interested in collecting shells or keeping your shell collection, what do you do? You can't take them with you! Well, after all of my research, I recommend two options: (1) leaving the entire collection to a shell club specifically designated as a non-profit organization in your Will or Trust and taking a tax write-off against your estate, or (2) leaving the collection to your family with the intent to have them donate the shells to a shell club allowing them to take a write off on the value of these donations.

When considering option1, it is important to know that the rules regarding charitable contributions are different for individuals than for estates and Trusts (http://www.pgdc.com/pgdc/know-differences-why-all-charitable-contributions-are-not-equal) For example,

- An estate or Trust income tax charitable deduction is potentially unlimited, while the deduction for individuals is capped at 50 percent of an individual's adjusted gross income;
- Estates are afforded a deduction for amounts permanently set aside for charitable purposes. Individuals (and generally Trusts) receive a deduction only for amounts actually paid to charities; and
- Estates can take deductions for donations to U.S. charities as well as to foreign charitable organizations. Individuals are permitted a charitable deduction only for donations to U.S. charities.

Knowing these differences, there will be little benefit if the executor of your estate donates property to a charitable organization because you cannot itemize the donation on your final personal tax return, nor is it a deduction from the value of your assets for determining whether your estate owes estate taxes. However, if you state in your Will or Trust that you would like your collection donated to a named charity, then this will count as a deduction for purposes of calculating any estate taxes that may be due (http://peopleof.oureverydaylife.com/basis-donating-inherited-property-3474.html). Option 2, allows your family to claim a tax deduction on the value of the shells if they donate your collection to a charitable organization. The value for tax deduction purposes will be the value of the

ISSN 0738-9388

shells as determined on the date of your death or the value given the collection by the executor when the estate assets are submitted for probate.

Charitable or non-profit organizations will often provide a letter recognizing the donation, which allows the donor to reduce their tax burden in the year that the items are donated. However, most will not provide a value for your donation, so it will be up to you and your heirs to make these determinations. The designated value of a given donation will determine whether an appraisal will be required under the U.S. Tax Code, *see* my article "The Collector's Catch-22". Consequently, if the collection has a substantial value, then it may be best to make multiple donations over several years to maximize the tax benefits. At a minimum, a comprehensive listing of the items being donated at any given time should be prepared and maintained with the letter received from the charitable organization in the event the IRS requires additional information. In addition, I recommend keeping an up-dated listing of the shells in your collection with either the current market value or the price you paid for each shell. Keep this listing on your computer and/or in hard copy form in an easily accessed location. I keep my hard copy next to my desk in a three ring binder labeled "Collections". The other important determination is which charitable organization would be best to receive your shell collection. Personally, I want an organization that supports marine research, one that promotes shell collecting in a conservation conscientious manner and provides programs for increasing the Public's awareness and knowledge of marine life. I would also like my collection to be enjoyed by as many collectors as possible; meaning I would like them to be distributed to other collectors. Consequently, selecting a club that meets these goals would be perfect. The San Diego Shell Club is one of these worthy non-profit organizations.

My decision to retain my collection during my lifetime is part of my nature as a collector. Feeling that my shells will be distributed to other collectors that will enjoy them provides comfort in knowing they will be taken care of and cherished when I am gone. Either of the options above will allow me to satisfy this desire and obtain a financial benefit for my family either personally or through my estate.

I hope that you have enjoyed this series of articles and that the information provided is helpful in making future decisions regarding your shell collection.

Dear Club members,

Remember: The San Diego Shell Club is ***your*** shell club. As officers of your shell club we want to better serve your needs. Contact any Board member and let us know what types of programs you would like to participate in, what topics you want to hear about in presentations, what shells you want to see in upcoming auctions, and where you would like to have meetings and events held. We hope to make 2017 even more fun!

David P. Berschauer, President

ISSN 0738-9388

2016 COA Convention in Chicago

By David Waller
505 N. Willowspring Dr., Encinitas, California 92024
dwaller@dbwipmg.com

Figure 1. Original art work for 2016 COA

What a fantastic event. Congratulations to the Chicago Shell Club and all its members. Special thanks to the Committee Chairpeople who made this convention possible: Amanda Lawless (Convention Chairperson); Jan Kremer (Auctions Chairperson); Ken Mattes (Bourse Chairperson); Stephanie Clark (Program Chairperson); Jochen Gerber (Field Trips Chairperson); Michael Cavallini (Registration Chairperson); Zhigang Ren (Publicity Chairperson); Linda Young (Banquet Chairperson); Theresa Jaffe and Jochen Gerber (Welcome Party Chairpeople); Dave Malusik (Door Prizes Chairperson); Katrina Frost (Volunteer Chairperson); Chuck and Mary Owen (Program Booklet); Margaret and Les Eastwood (Chicago Shell Club Sales Table) and Lynn Funkhauser and Carole Marshall (Photographers). I apologize if I missed anyone. The Chicago Shell Club made each and every attendee, including myself feel comfortable and welcomed.

The convention started with a series of presentations that were fantastic; I especially enjoyed the presentation by Vickie Wall on Shelling the Pearl Islands of Panama. These lasted for three days and were interspersed with silent auctions filled with beautiful shells from all over the world. I was very lucky to win a beautiful *Conus textile*. I know! I'm a cowrie collector but when you see a magnificent shell it doesn't make a difference what family the shell is from. Special events included the Welcome Party that was hosted by the Chicago Field Museum with the world famous "Sue", the *T. Rex* from the documentary "Curse of the *T. Rex*"; the oral auction with a number or rarities up for grabs (*i.e., Ophioplossolambis violacea, Harpa costata, Charonia tritonis* (389mm), *Austrasiatica langfordi, Conus scottjordani, Solaropsis gibbon cousin, Altivasum flindersi, Timbellus phyllopterus, Allonautilus scrobiculatus* and the big sale for the night *Zoila jeaniana aurata*. Other items included the original framed artwork for the show (*see* Figure 1 above), an ultrasonic shell cleaner and a four hour submarine trip); and the reception dinner at the end of the convention, which was an elegant affair.

The Convention ended with a two day bourse with shells galore. This years bourse was well attended with over 25 dealers showing shells that were out of this world. Some highlights include *Spondylus* from Jeff Wyman, rarities from Donald Dan, Australian shells from Hugh Morrison, Hawaiian shells from Dave Watts and shells from two or our own members Rick Negus and Don Pisor. I would like to list all of the dealers, but there is just not enough space to really give them the credit they deserve. All in all, it was a fabulous convention and the credit for making this possible must go to the volunteers and chairpersons of the Chicago Shell Club with special thanks to Amanda Lawless.

ISSN 0738-9388

Back Cover: Collage of species and subspecies named in The Festivus in 2016, including:*Oliva hirasei ameliae* Strano, 2016, *Haliotis arabiensis* Owen, Regter & Van Laethem, 2016, *Lautoconus saharicus* Petuch & Berschauer, 2016, *Harpa queenslandica* Berschauer & Petuch, 2016, *Camaena abbasi* Thach, 2016, *Amphidromus stevenliei* Parsons, 2016, *Marginella spadix* Veldsman, 2016, *Viduoliva tricolor abbasai* Thach & Berschauer, 2016, *Jaspidiconus boriqua* Petuch & Berschauer, 2016, *J. culebranus* Petuch & Berschauer, 2016, *J. janapatriceae* Petuch & Berschauer, 2016, *J. marcusi* Petuch & Berschauer, 2016, *J. masinoi* Petuch & Berschauer, 2016, *Miliariconus sinaiensis* Petuch & Berschauer, 2016, *Amphidromus bulowi malalakensis* Parsons & Abbas, 2016, *Vasticardium swanae* Maxwell, Congdon & Rymer, 2016, *Camaena chuongi* Thach, 2016, *Lamniconus petestimpsoni* Petuch and Berschauer, 2016, *Poremskiconus fonsecai* Petuch and Berschauer, 2016, *P. smoesi* Petuch and Berschauer, 2016, *Jaspidiconus josei* Petuch and Berschauer, 2016, *Fusinus damasoi* Petuch and Berschauer, 2016, *F. mariaodeteae* Petuch and Berschauer, 2016. (Cover artistic credit: Rex Stilwill)